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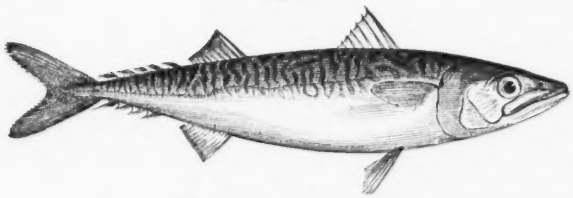
THE HABITS AND MIGRATIONS OF SOME OF THE MARINE FISHES OF MASSACHUSETTS.

BY JAMES H. BLAKE.

Fig. 108.



The Mackerel, *Scomber vernalis.*

THE part of Natural History relating to the habits of fishes is far behind other branches of this study, comparatively little being known of this interesting subject. The reason of this is plainly understood when we consider how small is the number of persons interested in such studies, who have the opportunity of observing the fishes a sufficient length of time to enable them to gain any great amount of information concerning them. Those who have the opportunity for gathering such information are of the class who look more to the financial profit from this business than to the benefit in knowledge they may gain. There is fortunately another class of individuals, who, while striving for their own maintenance, are careful to record the numerous

interesting facts which come under their observation; but, unhappily for science, this class is too small to occupy the field, and consequently we are kept in ignorance of this important matter.

The migration of the fishes on our coast may, in a measure, be compared to that of the birds on the land, both being governed by the seasons. The song birds, for instance, which frequent our villages during the summer and attract our attention by their musical strains, we greatly miss during the winter months, and we know that they have gone to parts where the temperature is better adapted for their subsistence and comfort. Those who reside at the seashore all the year observe movements among the fishes similar to those seen in the birds, and the time when each species of fish that is of value to the fishermen will make its appearance in any particular locality on the coast is practically known. Nearly all the fishes change their habitat as the different seasons advance, some by going to more northern or southern latitudes, while others move simply from deeper to shallower water, and *vice versa* to find the temperature they require.

There are no fish which remain in one and the same locality or fishing-ground the year around. Consumers of fish are acquainted with the fact that all our marketable fishes are found at a regular and limited period in our markets.

The Mackerel (*Scomber vernalis*), Fig. 108, come into the shallow water near the land directly from their winter habitat, the deep water of the Atlantic, during the months of May and June, and their annual appearance is very regular. They approach the coast for the purpose of spawning, and on reaching a favorable situation, immediately deposit their eggs, and leave them without farther protection. The number of eggs deposited in one season by each female is estimated to be between five and six hundred thousand. After spawning the fish move northward, following the line of the coast till they are checked by the chill of the water, when they return, and, in the month of November, seek the deep

water again. Those mackerel which first come in contact with the land at Cape Cod will migrate as far as the northern part of the coast of Maine. They are not easily caught with the hook during their spawning season, and it is at this time that "gill-nets" are used to the best advantage. The mackerel at this time are very lean, and the flesh has a darkish appearance, while at the time of their departure from the coast they are flat and plump, and are then considered to be in the best condition for food, and consequently bring the highest price.

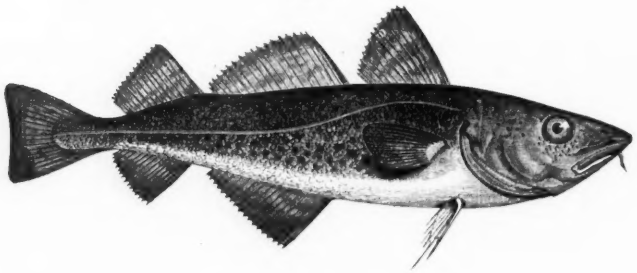
In comparing the number observed in one season with another the difference may be very great, but on the whole they cannot be considered as either increasing or decreasing in numbers. Some seasons they will be very plentiful, and schools of them may be seen near the surface of the water one or two miles in extent. When seen thus manœuvring in such great abundance they will not allow themselves to be taken with the hook very extensively; it is then that the purse-seines are used to the best advantage in capturing them. At other times, perhaps the following day, the fish will be entirely unobservable in the water, but when "tole-bait" is thrown over to "raise them," they will perhaps soon be seen by the side of the vessel in vast numbers, and will readily take the hook. Sometimes a crew of fifteen men will catch over a hundred barrels of them in a few hours. In those years when many fish are seen it has been observed that they are small, and that in those seasons in which the number is less they are large. This is probably owing in part to the number destroyed when young, and in part to the fact of a larger number than usual spawning on the outer banks.

Mackerel are always on the move and migrate in schools. In the spring, when they are caught in gill-nets, the quantity taken in the different nights varies considerably. Fishing with "drift-nets" is practiced in the night, for the fish cannot be caught in this way in the daytime, as the net is then

easily seen by them and avoided; they also swim deeper during the day, and would thus pass under or below the nets. The fishermen cast their nets about dusk; soon after, the fish are observed in them, and often before ten o'clock in the evening the nets will contain thousands of mackerel. The fishermen may visit the same locality the following night and be very unsuccessful, while the reports from other boats will show that the greater proportion of the fish were in another direction, and also that they move constantly and in large schools.

Mackerel, like most fishes, have their choice in respect to food. This consists of the young of other species and of

Fig. 109.



The Codfish, *Morrhua Americana*.

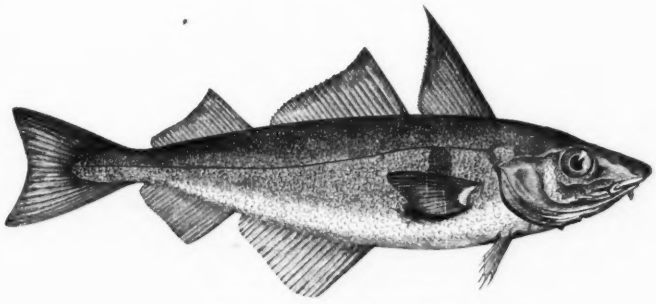
crustacea. The "tole-bait" consists chiefly of Menhaden (*Alausa menhaden*) ground very fine, with which clams are sometimes mixed, as they are believed to improve its quality. The bait commonly used for the hook is a piece of white skin cut from the throat of a mackerel, but when they are abundant and ferocious any white material will do; sometimes a small silver coin is used, and it is not uncommon for them to be taken on the bare hook.

The Codfish (*Morrhua Americana*), Fig. 109, is another familiar marine species, but one which differs very considerably in its habits from the mackerel. It is found in our markets all the year, but is not taken at all times from the

same locality or fishing-ground. This fish does not migrate along the coast, but acquires its desired temperature by gradually moving from shallower to deeper water, and returning as the season grows colder. Nearly all fish which go in schools migrate more or less along the coast after coming from the deeper water, while those which are distributed over the bottom, as the Cod, Haddock, etc., do not migrate except from shallower to deeper water.

Codfish visit the shallow water of Massachusetts Bay to spawn about the first of November, and towards the last of

Fig. 110.



The Haddock, *Morrhua æglefinus*.

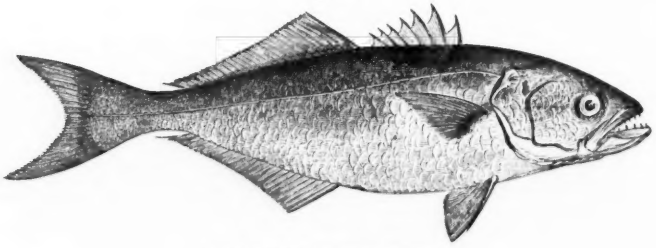
this month deposit their eggs on the sandy banks and rocky ledges.* About eight or nine millions of ova are annually deposited by each female. The codfish remain in the vicinity of their eggs till June, when they again retire to deeper water, the shallow water having become too warm for them.

The codfish, like the mackerel, takes no care of its eggs, and only a small portion of these ever arrive at maturity. Nature so regulates the destiny of these eggs that only a portion of them are permitted to mature, otherwise the

*G. O. Sars of Christiania, Norway, has observed that codfish deposit their spawn at the surface of the water, where the ova float throughout the whole of their development. He has followed up the development of the egg, and of the young, during the first fortnight after exclusion. The embryo leaves the egg on the 16th day. See Günther's Zoological Record for 1868. — EDITORS.

codfish would soon monopolize the whole ocean. These eggs are eagerly devoured as food by the various animals which inhabit the bottom, and the proportion of eggs destroyed in this and other ways cannot be readily estimated, but we know it must be enormous by the comparatively few young fish we see. If, during its stay in shallow water, the weather should suddenly become cold, and so remain for two or three days, the codfish immediately retreats to water of some forty fathoms in depth, and does not return till the temporary change has passed; then they gradually seek their

Fig. 111.



The Bluefish, *Temnodon saltator*.

former resort, which is a depth of fifteen or twenty fathoms. The Haddock (Fig. 110) at such times likewise retreats, but does not so soon return to its former station.

The quantity of codfish annually taken does not differ so much in the different years as does that of the mackerel, yet the amount is somewhat variable. The cause is the same in both cases, but as the codfish has a shorter distance to come the annual number is naturally less variable. The number of codfish existing at the present time does not appear to differ from that of twenty or more years ago, and I think we are safe in assuming that there has been no perceptible diminution for a century.

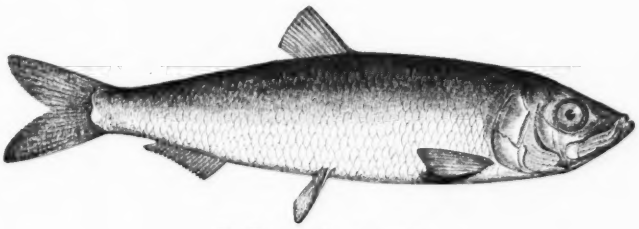
The food of the codfish consists of smaller fish, mollusks and crustacea. The bait considered by the fishermen as best adapted to their tastes are the common Herring (*Clupea elongata*), squid, etc., but clams (*Mya arenaria* and *Mactra*

solidissima) are more generally used, as only this bait can be obtained at all seasons of the year; clams are also found to remain longer on the hooks.

Nearly all the codfish obtained on our coast are brought to market in an unsalted condition, but they form only a small portion of the number sold in Massachusetts. The majority of the codfish sold here are brought from the Banks of Newfoundland and other great banks, and are always brought in a salted state.

We have already stated that although many hundred thousands of mackerel and codfish are captured through the agency of man, and many more are destroyed by other influences, there has been, notwithstanding, no noticeable change

Fig. 112.



The Herring, *Clupea elongata*.

in their numbers. But there are some species of fish which visit our coast that are constantly diminishing in numbers, and our shores were formerly frequented by some fishes in great quantities, which have now nearly, if not quite, disappeared.

The Bluefish (*Temnodon saltator*), Fig. 111, which inhabits our waters from the last of June till September, has had very marked periodic variations in numbers. This fish, as history informs us, was captured and esteemed as an article of food by the earlier settlers of this state. Previous to the year 1763 bluefish were very plenty on the southern coast of Cape Cod, but about this year they all disappeared, and none were taken till sixty or seventy years after. For the

past thirty years specimens have been taken, but they did not arrive in any noticeable abundance till within the last sixteen years, and are at the present time again vanishing. During the last mentioned period I have observed them about Provincetown in great abundance, where they often presented a beautiful spectacle. At times the splashing of the water caused by these fish in their rapid motions in pursuit of their prey, could be seen as far as the eye can reach. They make great havoc among their weaker neighbors, and some fishes have been entirely driven from our waters by this ferocious species. All fish which are a prey to the bluefish migrate on its first appearance. In the case of the mackerel, fishermen have noticed that when a few bluefish have been caught during the mackerel season, that a few days after not

Fig. 113.

The Bill-fish, *Scomberesox Storerii.*

a mackerel could be found, having been driven from the vicinity by the bluefish. I think it may be affirmed that the disappearance of so many of our smaller fish is due to the destructive nature of the bluefish; it even drives fish much its superior in size.

In respect to our smaller fishes, the Herring (*Clupea elongata*), etc., we observe a considerable decrease in the numbers which now annually visit our shores, as compared with their former numbers. The Poggy (*Alosa Menhaden*) and the Herring (*Clupea elongata*), Fig. 112, have comparatively almost deserted the waters about Provincetown, where I have formerly seen them in immense schools very near the shore. Fishermen made nets and other necessary preparations every year to capture them on their arrival in the spring, and the business was carried on extensively and profitably for many years, but at the present time no such fishing there exists.

The Bill-fish (*Scomberesox Storerii*), Fig. 113, which but fifteen years since I saw stranded on the shore by the thousands, driven in by its devouring pursuers, has gradually decreased, till at the present time it has nearly, if not quite, been driven away, and I think that during the past year there was not one specimen seen at Provincetown.

CULTIVATION OF ALPINE FLOWERS.

BY ALFRED W. BENNETT.

Mr. Robinson is no mere enthusiast in his subject when he says:—"This book ('Alpine Flowers for English Gardens') is written to dispel a very general error that the exquisite flowers of alpine countries cannot be grown in gardens, and as one of a series of manuals having for their object the improvement of our out-door gardening, which it appears to me, is of infinitely greater importance than anything that can ever be accomplished in enclosed structures, even if glass sheds or glass palaces were within the reach of all." His first concern is with the structure of rockeries, in the mode of building which not only is the taste still displayed, or at all events till quite recently, barbarous and inartistic in the extreme; but it would seem as if the very conditions necessary for the health of the plants were studiously neglected. The ordinary idea of the treatment of rock-plants, judging from the hideous monstrosities which may be seen in many a gentleman's garden, is that you have nothing to do but to poke them in between the chinks of perfectly bare stones or clinkers piled together in a promiscuous heap, in order to present them in their native habitats. A gardener who commits such an absurdity as this, can never have ascended a mountain with his eyes open. To quote again from Mr. Robinson:—"Mountains are often bare, and cliffs are

usually devoid of soil; but we must not conclude therefrom that the choice jewellery of plant-life scattered over the ribs of the mountain, or the interstices of the crag, live upon little more than the mountain air and the melting snow! Where will you find such a depth of well-ground stony soil, and withal such perfect drainage, as on the ridges of *débris* flanking some great glacier, stained all over with tufts of crimson saxifrage? Can you gauge the depth of that narrow chink, from which peep tufts of the diminutive and beautiful *Androsace helvetica?* No; it has gathered the crumbling grit and scanty soil for ages and ages; and the roots enter so far that nothing the tourist carries with him can bring out enough of them to enable the plant to live elsewhere." Alpine plants are peculiarly exposed to sudden alternations of heat and cold, of moisture and dryness. The cold, almost frosty, night will be followed, in July and August, by an unclouded day, when the rays of the sun beat on the unsheltered surface of the rock with an intensity that would scorch up many an English meadow plant. Only a very small proportion of alpine plants are annuals; and they are frequently provided with a storehouse of nourishment in the form of rosettes or tufts of thick succulent leaves; but their chief water supply is through their roots; and thus we find that while our garden annuals have fibrous roots of insignificant dimensions, and even our forest trees will seldom strike their roots to a greater depth than the height of their foliage, the roots of alpine plants, scarcely an inch in height, will be found to penetrate the chinks between the rocks full of rich earth, to the depth of sometimes more than a yard, or forty times the height that they venture into the air. The neglect of this most essential condition for the growth of alpine plants is of itself amply sufficient to account for the failure which has generally accompanied the attempts to introduce these lovely flowers to our rockeries. A good depth of soil is indeed more indispensable to these plants than the presence of rock and stone. They no doubt prefer to expand their

flowers and extend their green shoots over the bare rock; and where rock-work is artistically managed, this faint attempt at a reconstruction of their native habitat adds greatly to the picturesqueness of the effect. But many of them will flourish equally well in open borders, and even when planted in pots, with a few stones about them to protect the roots from the direct action of the sun, if only the two requisites are attended to, of constant moisture and perfect drainage; and hence they are invaluable acquisitions to the cottage or window gardener. The Saxifrages, the beautiful purple *Aubrietia*, with respect to which Mr. Robinson says, "rock-works, ruins, stony places, sloping banks, and rootwork suit it perfectly; no plant is so easily established in such places, nor will any other alpine plant clothe them so quickly with the desired vegetation," the various species of Arabis, the alpine Primulas, all make excellent bedding plants. The ease with which a new alpine can be domesticated in our climate is shown by the rapid spread of the lovely early forget-me-not, *Myosotis dissitiflora*, brought not many years since from the Alps near the Vogelberg, now to be had from every nurseryman, and the treasure of many a cottage garden, with its exquisite sky-blue flowers, continuing from mid-winter till early summer.

But it is not alpine flowers only which will repay the small amount of trouble necessary for their introduction. Many plants which are never grown without the protection of a greenhouse, do not require any elevation of temperature for their successful growth, but merely an absence of great changes of both temperature and moisture. This is especially the case with not a few of the most delicate ferns, such as the elegant maidenhair, and the two fragile little filmy-ferns; and the requisite uniformity of temperature and moisture can be obtained out of doors by the erection of a partially underground grotto or ravine of rocks, through which water is perpetually trickling, the entrance being protected by a screen of foliage from the direct influence of the weather.

It is astonishing how equable a climate can be obtained by a simple device of this kind. The drawing given on p. 359 is from such a rock-cave constructed in the grounds of one of our most scientific and successful nurserymen near York, where he grows not only our royal so-called "flowering fern," the *Osmunda regalis*, and several foreign allied species, but the most beautiful of all this beautiful tribe, the moisture-loving Killarney fern, which clothes the soil of the damp dark woods by the Tore waterfall.

The beauty of these horticultural experiments is that they can be tried on so small a scale, and are thus within the reach of almost every one; yielding a source of pure and healthy enjoyment which few other pursuits will afford. Mr. Robinson almost promises us that his little book shall be the first of a series of similar manuals on different departments of gardening; and we can hardly conceive a greater service than this to a large number of his countrymen, who merely require to be told how to set to work to cultivate this fascinating science. —*Quarterly Journal of Science.*

WHAT IS THE "WASHINGTON EAGLE"?

BY J. A. ALLEN.

Editors of the AMERICAN NATURALIST: *Sirs:* — Will you please inform me through the NATURALIST or otherwise, whether you have ever known of the Washington Eagle (*Haliaëtus Washingtonii*), being captured or seen in New Hampshire. I have an eagle in my possession which I think is the "Washington Eagle." It was caught last spring in Goffstown, near Manchester, N. H. It is a large bird, measuring eight feet from tip to tip of wings, three and one-half feet in length, and weighs fourteen and one-half pounds. I have also two other eagles, a Golden, and a Bald Eagle. The Golden Eagle measures seven and one-half feet from tip to tip, three feet in length, and weighs twelve and one-half pounds. The Bald Eagle measures seven feet in extent of wings, and three feet from point of beak to end of tail, and weighs eleven pounds. I think that the Bald Eagle has a differently shaped beak from the other, and that is why I am in doubt

as to its species. Besides, I never knew of a Bald Eagle being so large. If you will please inform me in regard to the Washington Eagle you will oblige me very much. — WILLIAM JARVIS, *Hanover, N. H.*

THE "Washington Eagle" (*Haliaëtus Washingtonii* Aud.) appears to be still looked upon, especially by amateur ornithologists, as a probably valid, though little known species. The question of its true character was formerly a source of perplexity to professional naturalists, some of which may still regard it as having claims to recognition as a "good species." As our knowledge of the birds of this continent becomes more perfect, the existence as valid species of several of the hypothetical species, especially of the rapacious birds, becomes less and less probable. This results principally from two facts. First, through the constant accession of materials in our museums we are every year finding out more and more definitely the variations resulting from sex, age, individuality and locality to which each species is subject, and in these variations the forms which with greater or less probability gave rise to some of the doubtful species in our catalogues. Secondly, the continent itself and its fauna are becoming too well-known to render tenable the suppositions, formerly entertained, that some of the strange birds described in early times may have their habitats in unexplored districts, whence they have occasionally wandered to better known localities. The opinion long since advanced by some writers that the "Washington Eagle" is but a very large immature Bald Eagle, is hence gaining ground.

Audubon described his "Bird of Washington" from a large specimen taken by him in Kentucky more than fifty years ago. The original specimen from which Audubon made his drawing and description is not known to be extant, and seems to have never been preserved. Audubon appears to have been the only naturalist who examined it. He regarded it as a very rare bird, and states that he saw not "more than eight or nine" specimens. He does not seem, however, to have actually examined more than one. It dif-

fered, according to Audubon, in three important particulars from the common Bald or White-headed Eagle (*Haliaëtus leucocephalus*); namely, in size, habits, and in the scutellation of the tarsi. Its size (length, "three feet seven inches;" alar extent, "ten feet two inches;" folded wing, "thirty-two inches") greatly exceeds that of any known North American eagle, while it differed in habits from the Bald Eagle in being a true fishing eagle, and the scutellation of the tarsus, as represented in Audubon's plate, is a character quite unusual in any of the eagles. It is now well-known that the common White-headed Eagle will catch its own fish, instead of resorting to piracy for them, as is its usual habit. In respect to the scales of the tarsus, those in front are represented as being considerably larger than they are in the common eagle, but as this is one of the first figures Audubon published, it seems not unreasonable to suppose that they may not have been quite accurately drawn, and that his description of them was made from the plate instead of the specimen itself. It is difficult, however, to account for its great size, since the proportions of length of body and folded wing, to the alar extent are the same as in the common eagle, and hence leave little ground for the theory that through a typographical error the alar extent should read *seven* feet two inches instead of *ten* feet two inches, as has been suggested.

As already remarked, Audubon really obtained but a single specimen; and, as Mr. Cassin has observed, no specimen precisely corresponding to Mr. Audubon's bird having been obtained since its discovery, it has latterly, as Mr. Cassin adds, "been looked upon by naturalists, especially in Europe, as an unusually large specimen of the White-headed Eagle."* Numerous local observers have, however, reported it as occurring occasionally at different localities, and Mr. Cassin himself has doubtfully referred specimens to it taken in New Jersey. He even includes it as a good species

* Illustrations of the Birds of California, Texas, etc., p. 111, 1854.

in his "Synopsis of North American Birds,"* and in his report on the rapacious birds in Professor Baird's great work on the "Birds of North America." If not a valid species, of which there seems to be but slight evidence, it must be either an immature White-headed Eagle or an immature Northern Sea Eagle (*Haliaëtus albicilla*), since these are its only known near allies, though neither of these are known to ever quite equal it in size. The White-headed Eagle ranges in alar extent from a little less than seven feet to a little more than eight; and the Northern Sea Eagle is of about the same size. That it is not the latter is evident from the fact that Audubon describes his bird as breeding in Kentucky, a locality far south of the known range of the truly arctic Sea Eagle. It would be one of the strangest facts in natural history that a bird like Audubon's Washington Eagle should remain undiscovered for more than fifty years, when its alleged habitat is within the settled parts of the United States. On the whole it seems to me tolerably evident that this supposed species should be considered as based on a large example of *H. leucocephalus*, and that a "few grains of allowance" may be safely made for slight inaccuracies on the part of its enthusiastic discoverer. The bird referred to above by Mr. Jarvis I regard as unquestionably referable to the *H. leucocephalus*.†

* Ibid.

† Farther remarks concerning the "Washington Eagle" may be found in the writer's "Catalogue of the Winter Birds of Florida," etc., in the "Bulletin of the Museum of Comparative Zoology," now in press, as well as concerning Bartram's mythical "Sacred Vulture," based on a singular combination of certain characters of the Caracara Eagle (*Polyborus tharus* Cassin), the White-headed Eagle (*Haliaëtus leucocephalus*), and the John Crow (*Sarcorhamphus papa*) of the West Indies. Reasons are there given also for referring the *Haliaëtus pelagicus* to the *H. albicilla*.

ACCLIMATIZATION OF FOREIGN TREES AND PLANTS.*

BY ALFRED W. BENNETT.

THE introduction of new forms of vegetable life into our gardens and greenhouses has made considerable progress during recent years. The Acclimatization Societies of Paris and London have, it is true, paid more attention to the domestication of foreign animals than of plants; something, however, has been attempted in this direction, and with considerable success. This branch of acclimatization would, indeed, seem likely to be the most fertile in results beneficial to mankind. For one fresh animal introduced that will be of real utility, there will probably be a dozen plants that yield important economical products. The early races of mankind appear to have exhausted our powers over the lower animals—the horse, the ass, the dog, the camel, the ox, the sheep, were all brought under subjection to man at the earliest period of his history; and within historic times no important addition has been made to the number of our domestic animals. Not so with plants. A large number of the vegetable substances used as food at the present day, and of the vegetable articles of manufacture, were unknown to the ancients; and the field for farther extension of our utilization of the vegetable kingdom seems indefinitely large. The power of cultivation in modifying plants is also much greater than any corresponding power of domestication in modifying animals. The oldest extant drawings of the horse, the ox, or the camel, scarcely point out any distinctive features from their descendants now living; the potato and the apple, on the other hand, may almost be considered as man-

*This article is introduced since it contains many hints of use to florists and gardeners in the middle states especially, where many subtropical plants can with care be made to grow. — EDITORS.

ufactured products; while many gardeners' flowers, such as the Pelargonium and the Tulip, differ so widely from their ancestors as, in some cases, to obscure their parentage. The term acclimatization has been objected to by some scientific men, on the ground that the descendants of any animal or plant which has been transported from one climate to another have no more power than their ancestor of adapting themselves to that climate, unless the principle of Natural Selection has come into play to eliminate the individuals least able to adapt themselves to the new climate, those only surviving which, from some cause or other, are most suited to the fresh conditions. Be this as it may, there is no question about the fact that the farmer and the gardener have it in their power to naturalize plants foreign to our climate and our soil.

But the conditions of this naturalization are by no means so simple as might at first sight appear. It might naturally be supposed that all we have to do is to introduce those plants which grow spontaneously in a climate and a soil similar to our own, and that they will necessarily flourish, and will scarcely be aware of the change. Or, if they come from a warmer country that all that is needed is to protect them by glass and artificial warmth from the inclemency of our winters. But in practice this is not found to be the case. A plant will frequently obstinately refuse to become naturalized in a country, the climatal and geological conditions of which are similar to those that occur in the region where it is indigenous. Our common daisy, a native of almost every country of Europe, is said to have resisted all attempts to introduce it even into the gardens of the United States. Some plants seem to have an unconquerable aversion to the fostering hand of man, even in their own country. A well-constructed and carefully kept fernery will contain specimens, more or less luxuriant, of nearly all our native ferns; the polypody and hartstongue from shady banks and tree-stumps; the so-called male and female ferns from the woods;

the spleenwort from dry walls; even the royal "flowering-fern" from bogs; and some of the semi-alpine species will flourish with the exercise of a little care. One kind, however, is almost invariably absent, and that the most widely distributed of all our ferns, the common break, a native of every county and almost of every parish in the country, but which can seldom be induced to remain a denizen of soil that has once been brought under man's dominion. On the other hand some of the greatest favorites of our gardens, which display no coyness whatever in overrunning our flower-beds, are natives of countries where the climate presents very different features to our own, or of very limited tracts of our own country, to which they seem strictly confined by impassable barriers of soil or meteorological conditions. To take instances of the latter phenomenon:—There is no garden flower more cosmopolitan in its tastes, more certain to thrive under any conditions of light or heavy soil, sun or shade, care or neglect, even in the heart of a town, as its very name seems to indicate, than the London Pride. Yet the *Saxifraga umbrosa* is one of the most restricted in distribution of our native plants. Abundant enough where it does grow, it is yet entirely confined to the moist equable climate of the hilly country in the south-west of Ireland and a few other similar localities, beyond which it is never found in the wild state. Botanists will think themselves amply repaid for a toilsome day's march by gathering the beautiful *Polemonium cæruleum* in its native habitat among the calcareous hills of the west of Yorkshire; yet the Jacob's Ladder is an ornament of every garden on the very stiffest part of the London clay. Probably every piece of cultivated ground, which contains a laburnum tree, produces each spring a plentiful crop of self-sown young trees, which come up without the least care or protection until destroyed in the process of weeding; yet the laburnum shows no disposition to take a place among the naturalized trees of our woods and hedges, although the seeds must often be carried there by

birds. It is remarkable that many of our common vegetables, the cabbage, the asparagus, the sea-kale, the celery, are natives of our own shores, never growing spontaneously out of reach of the salt spray; and yet requiring, when transplanted into our gardens, no peculiarity of soil or treatment to enable them to support a vigorous existence. These are instances of plants to which our climate appears entirely congenial, and yet which seem as if they could not propagate themselves with us or spread, except under man's protection. Others, again, appear to require only to get a footing in a foreign soil to become established in it with extraordinary rapidity, even to the overmastering or expulsion of some of the indigenous inhabitants. When Australia and New Zealand were first colonized by Europeans, their flora presented an aspect of perfect strangeness, very few of the native trees or flowers belonging even to genera common to Europe. The seeds of some of our English weeds were, however, introduced, intentionally or accidentally, by the early settlers; and now the thistle covers the waste lands of Australia as it does in England, and the clover and the groundsel everywhere remind the Englishman of his far-away home, and have become as completely at home as the mustangs or wild-horses on the pampas of South America. In our own country a very remarkable instance of this rapid naturalization has occurred in the case of the *Elodea Canadensis* or Canadian water-weed; which, introduced not many years since into our canals from Canada, has now become such a pest in many places as seriously to impede the navigation. Other instances might be mentioned of foreign plants introduced with seed having in a very short time become common weeds in all cultivated land. Indeed, many of the species included in our handbooks of British plants are so entirely confined to arable land or to spots in the immediate vicinity of human dwellings, that it is impossible to say how many of them may be really indigenous to the soil, and how many naturalized aliens.

There is no doubt we have a great deal to learn as to the mode in which plants propagate themselves in nature, which may be of the utmost value to our gardeners. Every one is familiar with the fact of the apparently spontaneous appearance in immense abundance, of plants in soil when subjected to certain farming operations, or on the sowing of some particular crop. Whenever a new railway cutting or embankment is made, some plant unknown in the neighborhood is almost sure to appear, and either permanently establish itself or again disappear after a few years. The "sowing" of land with lime is invariably followed by the appearance of a crop of white or Dutch clover. When certain kinds of wood are cut down it is said that during the next year a particular species of moss will always be found covering the ground. Immediately after the great fire of London in 1666, the London Rocket (*Sisymbrium Irio*) sprang up in enormous quantities on the dismantled walls, but is now no longer to be found in the metropolitan district. The usual theory to account for this sudden appearance of new plants is the existence in the soil of large "stores of seeds" ready to germinate on the first favorable opportunity. In his Anniversary Address to the Linnæan Society in 1869, Mr. Bentham, however, pointed out that if this explanation was the true one, it ought not to depend merely on theory, but would be capable of easy practical verification. He suggested whether a hitherto insufficiently acknowledged part in the rapid dissemination of plants may not be played by birds. The whole subject presents a wide field for farther investigation, and must amply reward any one who takes up the inquiry, if endowed with the qualities of accurate observation and patient research.

Mr. Mongredien's "Planter's Guide" deals chiefly with the introduction into this country of foreign trees and shrubs. Within the last twenty or thirty years the appearance of our lawns and plantations has been greatly changed by the number of new forms which have made their appearance. The

stately *Wellingtonia*, the formal self-asserting "Puzzle-monkey," or *Araucaria imbricata*, the massive Deodar and *Cryptomeria*, the elegant *Pinus insignis* and *Cupressus Lawsoniana*, are all still of too recent introduction to permit us to judge of what their effect will be when grown to their full stature. The number of cone-bearing trees from all parts of the world, perfectly hardy in this climate is extraordinary; and, partly from their graceful shape, partly from the evergreen character of their leaves, the attention of cultivators has been perhaps too exclusively confined to them, while deciduous trees have been comparatively neglected. Recent experiments have shown that in this quarter also there is abundant room for an extension of our powers of domestication. In one of the London Parks least frequented by the upper ten thousand, that at Battersea, great success has attended the introduction, during the last few years, of half-hardy trees and shrubs, the precaution being taken of protecting their roots during winter by a layer of some substance impervious to frost. The French have paid more attention to the perfect naturalization of half-hardy plants than we have done; notwithstanding the greater severity of their winter, species are grown by them out of doors which are never seen with us except in greenhouses; even as far north as Paris, the bamboo, for instance, is frequently met with in gentlemen's gardens; and there is no doubt that many shrubs and herbaceous plants, which we never think of attempting to grow except under protection, might, with a very little care and attention, become permanent denizens of our gardens and shrubberies. Probably few are aware that the common Camellia will stand with impunity an ordinary English winter. Mr. Mongredien says that "if protected during the first two or three years after being planted out, and when once established, it proves in the climate of London quite as hardy as the common laurel, and blooms as profusely as in a conservatory. It is true that, from its habit of flowering early in the spring, the blossoms are sometimes

damaged by the nipping easterly winds, but this occurs only in unfavorable seasons; and even if the tree never flowered at all, its lovely foliage would still make it one of the most beautiful evergreens of which our gardens can boast. A plant of the variety *Donkelarii* has stood out for twelve years in a garden at Forest Hill with a northern aspect, without the slightest protection during the severest winters, and now forms a good-sized bush, densely clothed with magnificent foliage. The Camellia ought to be planted out in every garden, and with a little attention for the first year or two, it would prove quite hardy, at least in the more southern counties, and each season it would increase in attractiveness."

The climate of the south of England is far more congenial to the introduction of foreign trees and shrubs than that of the northern counties, not from the greater severity of the winters in the north, for the minimum temperature of the year is often as low in Kent or Hampshire as in Yorkshire or Northumberland, but from the shorter and cooler summers. Many plants absolutely require a considerable period of high temperature to enable them to ripen their wood sufficiently to withstand the winter frosts, and especially to induce them to flower. In many parts of Scotland, however, the climate is as favorable to horticulturists as in any district in England. In the Duke of Sutherland's estate at Dunrobin, on the east coast of Sutherlandshire, Hydrangeas, myrtles, and other half-hardy plants, grow as freely and as unchecked out of doors as they do in Devonshire or Cornwall. The equalizing effect of the Gulf Stream on the temperature is no doubt the cause of this special immunity from frost. The proximity of the sea-coast is not generally favorable to the growth of trees and shrubs, not so much from the saltness of the air as from the prevalence of high winds, which are very injurious to growing vegetation. Young and tender shoots which will bear a moderate amount of cold, will sometimes be scorched as if by fire by a tempestuous night. — *The Quarterly Journal of Science.*

THE DISTRIBUTION OF THE MOOSE IN NEW ENGLAND.

BY J. A. ALLEN.

In consequence of their large size, the value of their flesh, and the pleasure attending their chase, the different members of the deer family (*Cervidæ*) are among the first to disappear before the progress of civilization in a newly settled country. The moose (*Alce malchis*), like the caribou (*Tarandus rangifer*), doubtless once existed in Southern New England, though I have seen no record of its occurrence in the southeastern portions since the settlement there of Europeans. It probably remained in the mountainous districts till a later period, but for many years has been extinct in Massachusetts, Southern Vermont and New Hampshire, and Southern Maine.

In answer to my inquiries in respect to its present southern limit in Maine, Mr. J. G. Rich, the well-known hunter and trapper, writes me in substance as follows: "Although now scarce in that state, it is first met with on the Penobscot at about eighty miles above Bangor; on the Kennebec north of the Forks in Somersett county; at Kennebago Lake, and to the northward of Rangely Lake in Franklin county; and north of the Agiscohas Mountain on the Margalloway River, in Oxford county." A few also exist in the extreme northern parts of New Hampshire and Vermont, and in the Adirondacks of New York. As the experienced hunter finds it a not very difficult animal to capture, the moose unless protected by law, must soon become extinct throughout the New England States. The legislature of Maine has already passed a stringent game law for their protection, which it is to be hoped may be carefully enforced.

Mr. Rich's long experience as a trapper and hunter in the Maine woods, has rendered him thoroughly familiar with the

habits of the moose and the other large mammals of this region; and some years since (in 1860) he published an interesting series of articles in the now defunct "Bethel Courier," on the "Wild Animals of Maine," in which he brought together facts of great value to the naturalist, including the most complete history of the moose yet extant. It is to be hoped that he will be able to soon reissue these valuable sketches in a more permanent form.

NOTES ON CERTAIN INLAND BIRDS OF NEW JERSEY.

BY CHARLES C. ABBOTT, M.D

THE ornithological fauna of New Jersey having undergone some changes within the last few years, it may prove interesting to ornithologists to have the results of ten years constant, careful observation as to the movements of our inland birds; comprising those that are resident; those coming from the South in the spring, and visitors from the North in winter. Certain species formerly abundant are now rare; and others formerly but seldom met with, are now abundant. As an instance we will mention the Summer Red-bird (*Pyranga æstiva*), which may no longer be accounted a summer resident, although prior to 1857 it was abundant; and on the other hand the Snow-bunting (*Plectrophanes nivalis*), which previous to 1865, was a very rare visitor, and then only during very severe winters, and since has as regularly appeared as the *Junco hyemalis*. They do not appear, like them, early in October, but after considerable snow has fallen. During the winters of '67, '68 and '69, they were so abundant that hundreds of dozens killed on the outskirts of the town (Trenton, Mercer Co.), were offered for sale in our markets. Every additional snow storm seemed to in-

crease their numbers. They were very fat, and, considered as delicate as the Rice bird, *Dolichonyx orizivorus*, in October.

It may be proper here to state that the climate, during the past thirty-eight years, has undergone no change other than a slight diminution in the quantity of snow.

The species to which I desire to call particular attention are

1. Pigeon Hawk (*Hypotriorchis columbarius*). During the early autumn, when the Reed-birds (*Dolichonices*), have gathered in the marshy meadows, and the Red-winged Starlings (*Agelaii*), fairly blacken the drier lowlands; when the "Flicker" (*Colaptes*), is rattling off the thin bark from the hickories, and congregated Blue-birds twitter from every panel of fence; when the unsought Meadow-lark (*Sturnella*) challenges you to discover his retreat, with his saucy "you-can't see-me," and timid snipe (*Gallinago*), with a nervous "scape" endeavor to avoid the gunner's aim with a most eccentric flight,—then really are the days proper of our birds of prey, and all of our species, from the magnificent Black-hawk (*Archibuteo Sancti-Johannis*), to the saucy Sparrow-hawk (*Tinnunculus sparverius*), are more or less abundant. Ever on the alert for wounded birds or rash Meadow-mice, they sail over the meadows from morning till night and add no little charm to the attractive scene; but while all this is the order of the day upon the lowlands, there is skulking along the fences of the uplands, and about the yards of the farm-houses, a shy, cunning falcon, ever watching the farmer's poultry and pouncing thereupon continually. We refer to the Pigeon-hawk (*Hypotriorchis columbarius*), a species numerous throughout autumn and winter, but especially interesting from the fact that it remains throughout the year quite frequently.

In May, 1863, a nest of this species, with young birds just able to fly, was found by the writer in a large sycamore, on Duck Island, Delaware River, near Trenton, N. J. In

February (22d) 1865, a nest with eggs was also found by the writer, in a large elm, on the Shabbaconk Creek, near Lawrence, Mercer county, New Jersey. Young specimens in pin-feathers have been killed, in August and November, by a cousin of the author, which were seen and identified by the latter.

New Jersey seems to be a sort of neutral ground, as well as half-way house in the matter of geographical distribution. It is the northernmost limit of the range of some; the southernmost limit of the range of others; and occasional breeding ground of many species. From unascertained, and we imagine unascertainable causes, there are many visiting species that remain or pass on, as it may happen. An ornithological note-book will for one year record probably a dozen species, of which no trace will be found during the following year, except during their passage north or south. In 1859, a cold storm overtook the Red-starts (*Setophaga ruticilla*) as well as many of the warblers. During the following month (June) there were more nests of warblers about Mercer county than the writer has found in the ten summers since.

Since 1865, we have seen no Pigeon-hawks between the dates of March 15th and October 15th. They may have escaped our notice, but we opine not. Next summer Mercer county may have a dozen nests of this species.

2. Red-bellied Woodpecker (*Centurus Carolinensis*). This Woodpecker makes its appearance in April very regularly, and reappears in equal or greater numbers in October, and some few have been met with during the winter. It seems strange that it does not breed within state limits, but it certainly does not, except in a few isolated instances; at least this is the conclusion the writer has arrived at, as in accordance with his own observations. Correspondents in the extreme northern and southern sections of the state have written me, however, that they have found both them and their nests in May. These letters were from Sussex and Cape May counties. As it undeniably breeds in Pennsyl-

vania and in New York, it is probable that the reason of the author's failure in finding their nests, except in one instance (vide Geology of New Jersey, p. 765), arose from the fact that the natural features of the sections of the state he happened in were not such as attract the species. It, however, *does not breed, as uniformly within state limits, as the five other species of Picidæ common to the state.*

The cutting off of the heavier growths of timber, and general alteration, and rendering of the country's surface tame by cultivation, must have the effect either of changing the habits of the birds, or of driving them from their former haunts. The latter is generally the case, and undoubtedly is so with reference to this species. The other *Picidæ* are still abundant except two species, *Melanerpes erythrocephalus* and *Hylatomus pileatus*. Throughout the winter the "Sapsucker (*Picus villosus*), and Downy Woodpecker (*P. pubescens*), are very sociable, and appear as much at home in the maples along our town streets, as in the orchards beyond the village limits.

3. Traill's Flycatcher (*Empidonax Traillii*). The great influx of feathered life that comes to our state in the month of May is so varied as to species, and the many varieties having their particular haunts whereto they hie, that it is no easy matter, even after several attempts, to learn just what have come; and later in the season just how many have remained. That the list will vary year after year is unquestionable; but the species now under consideration is not one that simply remains during the summer occasionally. They do so now regularly, although their numbers vary very considerably. During the past seven summers the writer has regularly met with them. Previous to 1863 they are not mentioned in any of his note-books. They are, with us, a very restless, wild bird, remaining among the topmost branches of tall trees, and in such situations building their nests.

A nest of the Yellow-bellied Flycatcher (*E. flaviventris*),

was found at Princeton, New Jersey, during the past summer, containing young birds. This is the only nest of this species we have ever seen, but have met with the bird during the breeding season.

4. Wilson's Thrush (*Turdus fuscescens*). 5. Hermit Thrush (*Turdus Pallasii*). 6. Olive-backed Thrush (*Turdus Swainsonii*).

Early in May, with the Chat (*Icteria viridis*), and House-wren (*Troglodytes ædon*), and spring birds generally, there appear in our gardens in town hopping close along the fence, upon the ground, modest little Thrushes, that at once attract the attention of the most careless observers by their general similarity to the grand Song-thrush (*Turdus mustelinus*), only *abridged*. With the same jerking of the tail, and a very similar chirp, they industriously overturn the dead leaves fallen the autumn previous, and gather from beneath them innumerable spiders, insects, and small worms. Every half hour this search for food is disturbed by a quarrelsome Wren, that is generally driven off when the Thrush becomes fairly angered, when it will resume its hunt for food. They at this time constantly chirp—never sing. These small Thrushes are referable to one, or all, as the case may be, of the three species we have named above.

Wilson's Thrush (*Turdus fuscescens*) is the less numerous of the three species previous to June 1st, and from then until October, is the most so. It breeds within state limits in greater numbers than do the "Olive-backed" or "Hermit," but is more retiring in its habits at this time of the year, and appears to wander very seldom any great distance from its nest, during incubation, and to remain in the neighborhood of the nest until those of its fellows and the allied species have begun to reappear from the north, when again they frequent town gardens as well as more retired "country" localities. This species at this writing (November 24th, 1869), is now in Trenton, New Jersey.

The Hermit-thrush (*Turdus Pallasii*) is said by Audubon

to be quite abundant in New Jersey during the summer (vide Birds of America, Vol. III, p. 30), but I cannot endorse this statement altogether; but there may have taken place a change since he wrote in the movements of this bird, especially as he gives the northern mountainous portions of Pennsylvania as the southernmost limit of the breeding locality of the *Turdus fuscescens*, which is now common to New Jersey. The "Hermit," as the writer has met with it, is about as one to eight in the numbers that breed here, comparing it with *Turdus fuscescens;* and as one to twenty, compared with the whole number of *Turdus Pallasii* that arrive here in May. They disappear from general observation about June 1st, and as Audubon has written "throwing itself into the depths of the forests, there spends the summer months, frequenting the lowest and most shady thickets." During the latter part of the month of August last, the writer heard one of these birds singing, for the first and only time. The song excelled that of *Turdus mustelinus*. Its usual note is a shrill chirp, not as frequently repeated as that of *Turdus fuscescens* or *Swainsonii*. They were last seen in Trenton, New Jersey, on the 20th of November.

The Olive-backed Thrush (*Turdus Swainsonii*) which was formerly more abundant than of late years, makes its appearance in May, with the two preceding species, and resembles them in all its habits. It is unquestionably the least abundant of the three, either as a migratory or resident bird. During the summer of 1866 (vide Geology of New Jersey, p. 768) the three species of Thrushes were unusually abundant; and during the summer, many Olive-backed Thrushes remained and bred. During the past ten years they have remained as compared with those of their numbers that went North, about as one to fifty. Certainly the proportion remaining is not less.

The habits of these Thrushes suggest the probability that changes in the climate must be taking place in the northernmost limit of their range, and to preserve an equal extent of

territory as breeding grounds, must come South in propor tion as they are compelled to relinquish territory at the North. At all events, there is a steadily increasing list of those migratory birds that formerly never remained in New Jersey during the summer, and that now do so, raising one or more broods during their sojourn. To this statement the writer would add another, that the number of "isolated instances" of migratory species remaining, is also increasing. How many such "isolated instances" must occur to make the breeding of the bird within state limits a fixed fact? One nest a year or a dozen? Is it probable that the young birds raised in an "isolated instance" recognize their birth-place the ensuing spring and so remain? Thereby we would have as the result of an accident, a permanent habit established among that particular species. Would we not?

7. Ruby-crowned Kinglet (*Regulus calendula*). 8. Golden-crested Wren (*Regulus satrapus*).

In the Kinglets, of all other birds, it would be supposed that we had those that were strictly, so far as New Jersey is concerned, a northern-breeding, Jersey winter-sojourning species; and, indeed, the great bulk of them are so, except that they go farther South, of course, as well as remain here. Nevertheless, they too, break in upon long established rules and the records of the books, and have both been found breeding in Sussex county, New Jersey. At least, we have as evidence of this their presence in June, and also that of their young in August. Of those that spent the winter and left in the spring of 1869, there remained probably one per cent. The impression I may have given of their numbers during the summer, in the Geology of New Jersey, p. 769, is erroneous, in so far as one might suppose that they were common at that season. They are rare, but diligent search will generally discover two or three in the course of the summer.

The Kinglets do not seem to be much affected by the severity of the winter; except that during severe snow-

storms they seek the sheltered woods. In the depths of winter they and the Winter-wren (*Troglodytes hyemalis*), the Creeper (*Certhia Americana*), and the Black-capped Titmouse (*Parus atricapillus*), enliven the woods, especially a wooded hillside with a southern exposure. Such a position is the most favorable by far, for finding these and other small winter resident birds. Unlike the Winter-wren (*T. hyemalis*), the Kinglets are not quarrelsome, but quietly from limb to limb, and tree to tree, flit incessantly, gathering the dormant insect life beneath the bark. To recur to the subject of their summer sojourn is it fair to suppose that those that do remain are old and too feeble to perform the journey north? If so, would they not also be too old for nidification and incubation? We think so; and so cannot account for the specimens in pin-feathers.

At this date (November 24th), both species of Kinglet are very abundant about the trees in the streets, and are remarkably tame.

9. The Worm-eating Warbler (*Helmitherus vermivorus*). 10. Blue-winged Yellow-warbler (*Helminthophaga pinus*). 11. Golden-winged Warbler (*Helminthophaga chrysoptera*). 12. Yellow-rumped Warbler (*Dendroica coronata*). 13. Hooded Warbler (*Myiodioctes mitratus*).

We have now to take up the question of the geographical distribution of certain birds in a somewhat different manner, and to discuss, or rather to assert that we are not entitled to that usually or heretofore accredited to us. Of the five species of Warblers we have named above, four (except *Dendroica coronata*) have so far eluded us, although we have searched earnestly for them, after the spring visitors had gone. Coming as they did with them, and leaving simultaneously we supposed, like them, they, too, had gone north. This was our experience up to the time of completing our report for the "Geology of New Jersey." Three summers have since passed, and as yet we have found not even one specimen of the four species later than June 5th, and no

authentic nest. Of the many Warblers' nests we discovered there were four that we failed to identify, the birds belonging thereto not appearing when we had opportunities of watching. The general appearance of these nests which had eggs in was that of species common with us, although the eggs were a little peculiar. We have not had, since 1866, during any one summer, very good opportunities for hunting birds; but being ever on the lookout for the four species in question, we think it strange if they did remain throughout the breeding season without our detecting them.

As we have shown that some species that have heretofore always sought breeding grounds north of us now remain, therefore why should not others, formerly with us, conclude also to make a change, even though it be the opposite from that of their cousins? The surface of our state has materially changed in its general aspect within the past thirty years, since Audubon visited it; and these changes may have driven off certain species that probably are abundant no farther north or immaterially so, say Pennsylvania and New York. The changes we refer to are the very general cutting off of the woods, and clearing out of swamps. Certainly nine-tenths of the shelter that existed for birds in 1840 is now no longer in existence. The question may now be pertinently asked that if there is less shelter, why are there more new comers than there are departures of former residents? This we admit seems strange, and we can only answer it by asking another question; why should birds so similar as the *Sylvicolidæ* be of so many minds? Again, the four species in question are not at all sociable in their habits, and the new comers are; so we can see that the latter could be contented where the former would not, provided that the climate suited them.

The Yellow-rumped Warbler (*Dendroica coronata*), presents to us an instance of climatic geographical distribution which has not been published we believe; and that is, that from September to June this species has been met with in

New Jersey, on each of the intervening months. My attention was first drawn to it, by noting several in March, before any other species of the family had appeared. In February of the following year one specimen was seen and shot, and since then (1863), it has been met with sparsely in November, December, and January. These scattered Warblers are associated with the regular winter residents, Creepers, Nuthatches and Titmice.

14. Butcher Bird (*Collyrio borealis*). *We have seen the Shrike as early as September quite abundant*, but more generally it is in December and January that it is to be readily met with. No species visiting us from the North is more uncertain in its movements, and occasionally a winter passes without any being seen about. The snowy winters are those in which they are most numerous, and during such a winter their peculiarities are more readily studied, as they are during "open winters" far more shy and retired in their habits. With us they follow closely after loose companies of Snow-birds (*Junco hyemalis*), and seem to live very largely upon them. On the approach of warm weather they do not all go beyond the boundaries of the state, as the writer has seen them in Sussex county during the breeding season. *But very few individuals do remain however.*

15. Winter Wren (*Troglodytes hyemalis*). So like them in its appearance, and arriving in as large numbers so closely upon the disappearance of the *Troglodytes ædon*, there is a wide spread impression among persons with a smattering of disjointed ornithology, that they are one and the same bird, and that simply the former habit of migration has ceased. This absurd idea has gained ground in consequence of the very great accession to their numbers of the *T. hyemalis* that now annually appear. During the winter they are one of our most numerous species, ranking with *Passerella iliaca* and *Lophophanes bicolor* in this respect.

Like the "Shrike" (*Collyrio borealis*), they, too, do not depart wholly from us in the spring. Their numbers with

us in summer are much less than might be supposed, however, from my note in the "Geology of New Jersey," p. 776.

16. Red-bellied Nuthatch (*Sitta Canadensis*). A careful observer of the birds that now (November) are enlivening our generally leafless trees will not fail to notice continually a woodpecker-like moving little bird that has as unmusical a note as ever fell upon one's ear or added cacophonic variety to a harsh mixture, for verily the music of the woods hath now departed. Of the three birds to which these remarks are applicable, we refer particularly to that named above. A strictly northern species, early in November by ones and twos they make their appearance in company with *Sitta Carolinensis*, and to the casual observer they appear to be one and the same. In their habits, they, with us, present nothing distinctive. They number, we should judge, about one to twenty compared with "*Carolinensis*," and three or four per cent. remain during the summer. The locality of their nests and breeding habits are generally the same as in *S. Carolinensis*.

17. Black-throated Bunting (*Euspiza Americana*). Although abundant during the summer in Pennsylvania, less than one hundred miles from the state line (Delaware River), we had never, up to the end of the summer of 1867, been able to see these birds later than May, until they appeared in numbers in September. In the spring of 1868, and again during the past spring and summer, we found in various localities colonies of them breeding in low bushes, several nests being found in one field. We believe that for some reason we have not ascertained, they have annually left the state to breed and then reappeared. They are now with us (November) and we think that a few remain during the winter.

18. Rusty Black-bird (*Scolecophagus ferrugineus*). During the summers of '67, '68 and '69, these birds have been quite abundant about Trenton, New Jersey, associating with

the *Quiscalus versicolor* and *Agelaius phœniceus*. They built their nests invariably in trees growing upon the banks of streams, raising one brood only.

19. Snipe (*Gallinago Wilsonii*). We find on conversing with intelligent observers throughout the state, that in the immediate neighborhood of all those tracts of meadows where the Snipe first appear in March, or even earlier, that quite a number remain during the summer and breed. This has been our opinion and coincides with the results of our observations about the extensive tract of meadow extending along the Delaware River from Trenton to Bordentown, New Jersey. During the past few years we think the number remaining has increased steadily. In the autumn many arrive from the North and remain a longer or shorter time according to the weather. Indeed, so long as the ground is not too much frozen to enable them to feed, they are abundant; and after the formation of thick ice some still remain, resorting to spring-holes, and such open water as gives them a chance to thrust their bills in the mud; but we cannot imagine what they then find to eat. During the winter we have examined the stomachs of many, but the mass contained therein was invariably so far digested as to render it impossible to recognize anything, except that it appeared to be largely animal matter.

20. Tell-tale Sandpiper (*Gambetta melanoleuca*). 21. Yellow-legged Sandpiper (*Gambetta flavipes*).

Early in May, following the course of the Delaware River, these birds in company with other *Scolopacidæ* arrive in the neighborhood of Trenton, New Jersey, and on the muddy shores and marshy inland of Duck Island, and the extensive sand bars and grassy islands near and above the city mentioned, make themselves at home. By the first of June the great majority have gone North; but with the few smaller species that remain, and the myriads of *Tringoides macularius*, the "Tell-tale" and "Yellow-legs" now reduced in numbers, associate, and when feeding along the river act

as guides, apparently, and certainly as guards. Being at this time of the year very shy, they give notice of the approach of danger, and leading the flock, "Tell-tales," "Yellow-legs," "Solitaries" and "Teeter," fly in large circles, at a great height, and then resume their feeding near where they were previously to being flushed. During the breeding season, if frequently disturbed while feeding, they fly to their nests.

Both the "Tell-tale" and "Yellow-legs" have been found breeding in Mercer county, New Jersey. They seek some quiet nook along a small stream, and in the high grasses build quite a substantial nest, raising one brood that leaves the nest before being able to fly. At this time they are a dull mouse color, and when approached, squat so closely to the ground and remain so motionless, that it is nearly impossible to detect them.

22. Solitary Sandpiper (*Rhyacophilus solitarius*). Although the numbers remaining in New Jersey during the summer vary very much, we have never failed to find them during June and July, and August brings them again plentifully from the North. They breed as regularly in the state as the *Spizella socialis*, if not as abundantly. While the number of isolated specimens we meet with is large enough to warrant the descriptive name *solitarius*, yet many are seen associated with the other Sandpipers, especially in May and early autumn.

23. Mallard (*Anas boschas*). 24. Green-winged Teal (*Nettion Carolinensis*). 25. Blue-winged Teal (*Querquedula discors*). 26. Buffle-headed Duck (*Bucephala albeola*).

There is generally in April or May a freshet in the Delaware River, and one that usually overflows the tract of meadow mentioned when speaking of the Snipe (*Gallinago Wilsonii*). During the prevalence of this high water the ducks usually make their appearance in large numbers, feeding over the meadows in loose flocks, the species being the Mallard (*Anas boschas*), Black-duck (*Anas obscura*), Sprig-tail (*Dafila acuta*), the two Teal (*Nettion Carolinensis* and

Querquedula discors), Shoveller (*Spatula clypeata*), Widgeon (*Mareca Americana*), Wood Duck (*Aix sponsa*), Whistler (*Bucephala Americana*), and Buffle-head (*Bucephala albeola*).

After the waters have subsided they generally congregate at the river, and after a week or more, during which time many are killed, they have left. But not wholly so, as during the summer months, besides the beautiful *Aix sponsa*, which we always have, there are quite a number of *Anas obscura* always to be met with, and not unfrequently the four species we have mentioned above. Of the four species the Mallard is the most abundant, and the "Buffle-head" least. That they all breed in the state there can be no question.

We conclude with the above, the selections from our notes, made in the field and at various times, on the peculiarities, if we may call them such, in the ornithology of New Jersey, with the thoughts they have suggested, believing they will be of interest to those especially giving attention to the subject of geographical distribution. Of the three hundred species of birds included in the ornithic fauna of New Jersey, of course there are many that are exceedingly rare in our territory. Among some species there have happened freaks of habit, unique instances so far as our experience goes, that though entertaining, are doubtfully of sufficient value to warrant their publication; but as apparently trivial occurrences have sometimes proved a help in the solution of difficult questions, we propose to give a plain narration of one or more such occurrences.

In January, 1869, an acquaintance in hunting over the Delaware (Trenton) meadows for hawks came to a lively spring in a hillside having a southern exposure. As he was about leaving it he flushed from grass still green and long, a pair of Virginia Rails (*Rallus Virginianus*), and fortunately killed them. They were both *fat*, showed no signs of having been previously wounded and thereby detained, and

flew as rapidly and with as much apparent vigor as in September. Farther search failed to discover others at the time. Two weeks later *three others were killed*, and in the first week of February, *one more*. These latter specimens were equally fat and vigorous. No similar circumstance has come under our notice.

Similar instances of the presence of the Night Heron (*Nyctiardea Gardenii*) have three times come under our notice. We have found these birds sitting on trees near springs, from whence the water flowed swiftly, and about which the grass remained quite fresh. Leaving them undisturbed, but watching them frequently, they were never seen to leave their perch. From the accumulation of droppings it was evident that the particular branch even, on which they were first seen, was that on which they had been resting for some time past. Only single specimens have been thus found, all male birds, and they have always been much emaciated. When forced to move they all proved able to fly, but returned to their accustomed place, after a circuitous flight of short duration. Were they too old to go South? Did they get any food? If so, what and where? On dissection the stomachs of these three specimens proved to be empty, but the *uppermost droppings were fresh!*

THE FORMER EXISTENCE OF LOCAL GLACIERS IN THE WHITE MOUNTAINS.*

BY PROFESSOR L. AGASSIZ.

TWENTY-THREE years ago, when I first visited the White Mountains, in the summer of 1847, I noticed unmistakable evidences of the former existence of local glaciers. They

* Read, in the absence of Professor Agassiz, by J. B. Perry, before the American Association for the Advancement of Science, Troy meeting, Aug., 1870.

were the more clear and impressive to me because I was then fresh from my investigations of the glaciers in Switzerland. And yet, beyond the mere statement of the fact that such glaciers once existed here, I have never published a detailed account of my observations, for the simple reason that I could not then find any limit or any definite relation between the northern drift and the phenomena indicative of local White Mountain glaciers; nor have I ever been able since to revisit the region for more careful examination. This year a prolonged stay among these hills has enabled me to study this difficult problem more closely, and I am now prepared to show that the drift, so-called, has the same general characteristics on the northern and southern side of the White Mountains. Whatever, therefore, may have been the number of its higher peaks which at any given time, during the glacial period, rose above the great ice sheet which then covered the country, this mountain range offered no obstacle to the southward movement and progress of the northern ice fields. To the north of the White Mountains as well as to the south, the northern drift consists of a paste more or less clayey or sandy, containing abraded fragments of a great variety of rocks, so impacted into the minutely comminuted materials as to indicate neither stratification nor arrangement or sorting, determined by the form, size or weight of these fragments. Large boulders and pebbles of all sizes are found in it throughout its thickness, and these coarser materials have evidently been ground together with the clay and sand under great pressure, beneath heavy masses of ice; for they have all the characteristic marks so unmistakable now to those who are familiar with glacial action: scratches, grooves, furrows, etc. These marks are rectilinear, but they cross each other at various angles, thus showing by the change in their direction that the fragments on which they occur, though held for a time in one and the same position while these straight lines were engraved upon their surface, nevertheless changed that position more or less frequently.

A few flatter fragments with more angular outlines show only one kind of scratches, having evidently been held for a longer time in the same position. This drift, however it may vary in its mineralogical components in different localities, exhibits everywhere the same characteristic treatment over the whole country, from the shores of the Atlantic to the Rocky Mountains and beyond. In the White Mountain region it has the same mineralogical character north and south of the range, and rests everywhere upon the well known *roches moutonnées*, in one word, upon the planed, grooved, polished and scratched surfaces of the rocks underlying it.

Observation has taught us that materials such as those described above, so combined, exhibiting the same characters in their surfaces and having the same diversity of composition and absence of all sorting or regular arrangement, occur now at the bottom of the great glaciers of our time, and nowhere else; being found between the ice and the rocks over which it moves,—the result in fact of the grinding action of advancing glaciers. On account of their unvarying position I have called these deposits "ground moraines," because they are always resting upon the rocky floor of the country, between it and the under surface of the ice. Our typical unaltered so-called *northern* drift is synonymous with the ground moraines of the present day, differing only in its greater extension. It is in fact a ground moraine spreading over the greatest part of the continent. All its characteristics, identical in every detail with those of the deposits underlying the present glaciers, show that it can only have been formed under a moving body of ice, held between it and the underlying mass of rock. The great ice sheet of the glacial period which fashioned the drift must therefore have been co-extensive with the distribution of the latter. It is very important to distinguish this drift from the moraines formed under other circumstances, and from the so-called erratics and perched blocks. Moraines, as commonly understood, that is, lateral and frontal mo-

raines, consisting of loose materials collected along the sides and at the terminus of a glacier, always indicate, and, where undisturbed, actually define the margins of a moving mass of ice; whereas the so-called median moraines formed along the line of junction of the glaciers are carried upon the back or upper surface of the ice, and always consist of angular materials, the shape and arrangement of which are determined by their mode of accumulation. Just as among the glaciers of the present day we discriminate between ground moraines, lateral, frontal and median moraines, so must we also distinguish between the same phenomena in past times. The glacial period had also its ground moraines, its lateral, its frontal and its median moraines, its erratics and perched boulders. But the huge ground moraine of the earlier ice time stretched continuously, like the ice sheet under which it was formed, over the whole country—from the Arctics to the Southern States, and from the Atlantic to the Rocky Mountains. I do not speak of the western slope of the Continent, because I have not examined it personally. The great angular erratics of that period were scattered irregularly over the country, as the few large boulders are scattered on the upper surface of a glacier now. It is the contact of the more limited phenomena of the local glaciers which succeeded this all embracing winter (their lateral, frontal, median and limited ground moraines and their erratics), with the more wide-spread and general features of the drift that I have been able to trace in the White Mountains this summer. The limits of this paper will not allow me to do more than record the general facts, but I hope to give them hereafter more in detail and with fuller illustrations. The most difficult part of the investigation is the tracing of the erratics to their origin; it is far more intricate than the identification of the origin of ordinary drift, or of continuous moraines, because the solution of the problem can only be reached under favorable circumstances where boulders of the same kind of rock can be followed from distance to distance, to the ledge

in situ from which they were detached. Now, in the neighborhood of the White Mountains, we find beside the typical or northern drift, large erratic boulders as well as lateral, frontal and median moraines. A careful examination of these shows beyond a doubt that they came from the White Mountains and not from the northern regions, since they overlie the typical drift which they have only here and there removed and modified. A short description of the facts will leave no doubt upon this point.

The finest lateral moraines in these regions may be seen along the hillsides flanking the bed of the south branch of the Amonoosuck, north of the village of Franconia. The best median moraines are to the east of Picket Hill and Round Hill. These latter moraines were formed by the confluence of the glaciers which occupied the depression between Haystack and Mt. Lafayette, and that which descended from the northern face of Lafayette itself. These longitudinal moraines are particularly interesting as connecting the erratic boulders on the north side of the Franconia range with that mountain mass, and showing that they are not northern boulders transported southward, but boulders from a southern range transported northward. But by far the most significant facts showing the great extent of the local glaciers of the White Mountain range, as well as the most accessible and easily recognized, even by travellers not very familiar with glacial phenomena, are the terminal moraines to the north of Bethlehem village, between it and the northern bend of the Amonoosuck river. The lane starting from Bethlehem street, following the Cemetery for a short distance, and hence trending northward, cuts sixteen terminal moraines in a tract of about two miles. Some of these moraines are as distinct as any I know in Switzerland. They show unmistakably by their form that they were produced by the pressure of a glacier moving, from south, northward. This is indicated by their abrupt southward slope, facing, that is, toward the Franconia range, while their northern face has a

much gentler descent. The steeper slope of a moraine is always that resting against the glacier, while the outer side is comparatively little inclined. The form of these moraines, therefore, as well as their position, show that they have come down from the Franconia mountains. A few details concerning their location may not be out of place, in order that any visitor interested in the facts may readily find them without a guide. The ground to the north of Bethlehem slopes gently northward, and is not wooded for about half a mile from the street. Following the lane above mentioned, the first moraine reached skirts the edge of the wood and is near the houses of Mr. Phillips; there are four others more or less distinct before reaching a little trout brook called "Barrett's Brook." The lane descends more rapidly toward the brook than before, and where the descent begins to be steep the eye commands the space between the brook and a higher ground on which stands a house owned by Henry McCulloch. Over that interval six very fine moraines may be counted, one of which is perhaps the finest specimen of a terminal moraine I have ever seen. Beyond McCulloch's there are five more, not quite as distinct. The ground beyond the termination of the glacier of the Rhone in Switzerland is celebrated for its many distinct concentric terminal moraines; but here we have a field over which within the same area a larger number of such moraines may be seen, and I believe that a pilgrimage to this spot would convert many a sceptic to the true faith concerning the transportation of erratic boulders, especially if he has seen the glacier of the Rhone and can compare the phenomena of the two localities.

The Littleton road from Bethlehem, and the roads to Franconia Notch from both these towns frequently intersect terminal moraines. Those familiar with the topography of the Franconia range and its relation to Picket Hill and the slope of Bethlehem, will at once perceive that the glacier which deposited the front moraine to the north of Bethlehem village must have filled the valley of Franconia to and above

the level of the saddle of Picket Hill, making it at least fifteen hundred feet thick, if not more; thicker in short than any of the present glaciers of Switzerland. It will be observed, also, that as soon as the northern portion of that glacier had retreated to the wall which encircles the Franconia Valley on the north, the glacier occupying henceforth a more protected valley within the ranges, must have made a halt and accumulated at this point, that is, south and west of the saddle of Picket Hill, a very large terminal moraine. This moraine actually exists to the present day, and is one of the most characteristic features of the distribution of erratics in these regions. From the moment the glacier was reduced to the level of Franconia bottom it must suddenly have vanished entirely from the whole valley, and thus it happens that no other large terminal moraines are seen between that just mentioned and the higher range of Franconia.

Moraines similar to those observed on the northern side of the White Mountains exist also on their southern side in the vicinity of Centre Harbor. Lateral moraines may be traced at the foot of Red Hill, a little above Long Pond; also along Squam Lake. Median moraines are very distinct near Centre Harbor Hotel. Terminal moraines are also numerous near Centre Harbor and in the neighborhood of Meredith. At the southern end of Red Hill the lateral moraines trend westward and show their connection with the terminal moraines. These facts, taken in their relation with those enumerated above, show that there were local glaciers, on the southern as well as the northern slopes of the White Mountain ranges, moving in opposite directions; those on the northern slope moving northward, and those on the southern slope moving southward. I have seen no evidence thus far of these northern glaciers extending beyond the range of hills which separates the Amonoosuck River from the Connecticut River valley west of Lancaster, nor have I traced the southern glaciers beyond Lake Winnipesaukee. Traces

of an eastern glacier moving westward may be seen near the Twin Mountain House; but I have not examined that region with sufficient care to give minute particulars.

All these moraines and traces of local glaciers overlie the typical or northern drift so-called, wherever the latter has not been entirely swept away by the local glaciers themselves; thus showing that the great ice sheet was anterior to the local glaciers, and not formed by a spreading of smaller preëxisting glaciers. At least, wherever I have recognized traces of circumscribed glaciers in regions where they no longer exist, it has always appeared to me that the minor areas covered by ice were remnants of a waning sheet of greater extent. If the glacial period set in by the enlargement of limited glaciers already formed and gradually spreading more and more widely, as Lyell and the geologists of his school suppose, the facts which would justify such a view are still to be made known. I have not seen a trace of them anywhere. On the contrary, throughout the ranges of the Alps, in the Black Forest, the Vosges, as well as in the British Islands, in Scotland, Wales and Ireland, I have everywhere satisfied myself that the more extensive the glaciated areas, indicated by polished surfaces and moraines in any given locality, the older they are when compared with glacial phenomena circumscribed within narrower limits.

It therefore follows from the facts enumerated above, as well as from a general consideration of the subject, that the local glaciers of the White Mountains are of more recent date than the great ice sheet which fashioned the typical drift. On another occasion I hope to show that the action of the local glaciers of the White Mountains began to be circumscribed within the areas they covered, after the typical drift had, in consequence of the melting of the northern ice sheet, been laid bare in the Middle States, in Massachusetts and Connecticut, after even the southern portions of Vermont, New Hampshire and Maine had been freed, and when the White Mountains, the Adirondacks and the Ka-

tahdin range were the only ice clad peaks in this part of the continent.

When in their turn the glaciers of the White Mountain region began to melt away, the freshets occasioned by the sudden large accumulation of water remodelled many of these moraines and carried off the minute materials they contained, to deposit them lower down in the shape of river terraces. I have recently satisfied myself, by a careful examination, that all the river terraces of the Connecticut River valley and its tributaries, as well as those of the Merrimack and its tributaries, are deposits formed by the floods descending from the melting glaciers. What President Hitchcock has described as sea-beaches and ocean bottoms near the White Mountain and Franconia Notches, as well as in the Connecticut River valley and along the Merrimack, have all the same origin. The ocean never was in contact with these deposits, which nowhere contain any trace of marine organic remains.

NATURAL HISTORY MISCELLANY.

BOTANY.

RICHARDSONIA SCABRA, a tropical American Rubiaceous weed, has every now and then been picked up and sent us from Georgia or Alabama; and if it is Pursh's *Spermacoce involucrata*, as is probable, it was introduced more than half a century ago. It appears that it is now taking wide possession of the soil in the piney region, and that it may play an useful part. Dr. F. J. B. Rœhmer, of Mobile, Alabama, writes of this plant as follows:

"This plant was comparatively rare here twenty years ago, but is now very common throughout the piney wood region of Alabama skirting the Gulf coast. It seems to choke out all the grasses by its more luxuriant growth. It is known by farmers, as "Mexican Clover," and may possibly have been introduced during the Mexican war, as it is said to grow in the rear of Vera Cruz. It is relished by all kind of stock, either green or cured.

In my capacity, during our late war. as botanist and chemist for the de-

partment of the Gulf, I introduced the roots of this plant into the supply table of the Confederate States Army, as an indigenous succedaneum for the true Ipecac, then exceedingly scarce, and as a substitute for the Euphorbias which had been recommended, but which were too violent in their operation, and I can say that in increased doses it answered every purpose."

Acclimatization of Palm Trees. — In addition to the date-palm and the *Chamærops*, which have long been naturalized on the European shores of the Mediterranean, M. Naudin has succeeded very well with several other kinds at Collioure, in the Pyrenees, notwithstanding the exceptionally unfavorable character of the winter of 1869-70. The severe cold of the last week of December, when the thermometer descended to — 4°, and in some localities even to — 6° C., was fatal to only one species. The extraordinarily heavy fall of snow which took place in January, lasting for forty-four hours without intermission, was expected to destroy the young trees altogether. After, however, they had been entirely covered up with snow for nine or ten days, so that the boughs were completely flattened, when the thaw came they almost immediately recovered their former position, even the green color of the leaves not being injured. The same fall of snow caused a fearful amount of destruction among the olives and cork-oaks. — *Quarterly Journal of Science.*

ZOOLOGY.

London Zoological Gardens. The whole number of animals in the Zoological Society's Gardens, usually somewhat exceeds 2000. On the first of January last, it was 2,031, consisting of 598 mammals, 1245 birds, and 170 reptiles and batrachians, besides the fishes in the aquarium, which do not appear to be included in the annual census. Constant additions are made to the series, not only by purchase, but also by gifts of correspondents in every part of the world, and by exchange with the continental establishments. — *Nature.*

The Nesting of the Fish Hawk. — Mr. Samuels in his "Birds of New England," speaking of the fish hawk, says "that seldom more than one nest is found in one locality" (in New England). At Harpswell, Maine, situated about twenty miles east of Portland, I know of at least fifteen nests of the fish hawk within one square mile. I think I might safely call the number twenty, but as I am writing I can only *distinctly* remember fifteen. A short time since speaking to a gentleman who has for many years lived at Harpswell, of what I had read in Mr. Samuel's book, he said, "tell him you know of a place where there are fifty nests within three miles, and I can find more places like it." These nests that I speak of were all on two small islands. These islands I visited exclusively, but I see no reason why there should not be nests on the rest also. On both of these islands the great blue heron and the night heron breed together

in quite large numbers. Mr. Samuels also says that they never molest their feathered neighbors. I have repeatedly seen the fish hawk attack the night heron and pursue it for a short distance. There seemed to be no reason for these attacks, but the hawk appeared to be venting his ill-humor upon the poor heron for want of some other object. Once when in a boat with two companions we saw a fish-hawk attack some water-fowl (the distance was too great to make out with certainty what it was), that was swimming by near its nest. The bird dove and the fish-hawk hovered about till it reappeared, when it renewed its attack. This performance lasted for a few minutes, and ended by the fish hawk's desisting from his assaults. — WALTER WOODMAN.

GEOLOGY.

GLACIERS IN PALÆOZOIC TIMES. — In "Notes on an ancient Boulder Clay of Natal," Dr. Sutherland describes an ancient "boulder clay," consolidated into a clay stone porphyry, "perhaps of Permian age," which rested generally upon old Silurian sandstones, the upper surface of which was often deeply grooved and striated. Mr. T. M'K. Hughes, while admitting the probability of a recurrence of glacial periods, disputed the evidence in this particular case. Prof. Ramsay "pointed out that in the Natal beds, under discussion, enormous blocks of rock occurred, which were sixty or eighty miles from their original home, and still remained angular; and there was a difficulty in accounting for the phenomena on any other hypothesis than that suggested. He still maintained the probability of the occurrence of glacial episodes, not only in the Permian, but in other ages, as he had done, now fifteen years ago." — *Proceedings of the Geological Society of London, reported in Nature.*

RECENT AND FOSSIL COPAL. — At the meeting of the Linnean Society held May 5th, Dr. J. D. Hooker read a communication from Dr. Kirk, Her Majesty's Vice-Consul at Zanzibar, on the distinction between the recent and fossil states of the resin known in commerce as Copal. One characteristic by which fossil copal is known from the recent resin is the so-called "goose-skin." Dr. Kirk has ascertained that the fossil copal shows no trace of this goose-skin when first dug out of the earth, but that it makes its appearance only after cleaning and brushing the outer surface. Both descriptions often contain imprisoned leaves, flowers, and insects in a beautiful state of preservation; but the fossil variety is clearer and more transparent. Captain Grant states that the true copal gum-tree is a climber reaching to a great height among the forest trees, finally becoming completely detached from its original root, when the copal exudes from the extremities of these detached roots. Large pieces of the resin fetch a very high price even in that country. — *Quarterly Journal of Science.*

AMERICAN ASSOCIATION.

NINETEENTH MEETING OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE, HELD AT TROY, N. Y., AUGUST 17TH–24TH. 1870. [*Abstracts of papers continued from the October Number.*]

Mr. W. H. DALL gave a short account of some researches into the structure of the Eskimo languages in which he was engaged. He showed how the radical words of the different dialects from Greenland to Bering Strait were essentially the same, while many of the adjectives, verbs and prepositional terminations differed in tribes which were closely adjacent. He then gave a description of the multiform changes of the termination of the verbs, showing that the Eskimo of Repulse Bay had, in the indicative mood of a transitive verb, five forms, only one of which (the present) had an exact equivalent in English. They were the present form or tense; the past imperfect, indicating an action just performed; the past perfect, indicating an action performed long ago; the future, relating to an action about to be performed; and the future perfect, which denoted an action to be performed in some future time.

The termination changing with the singular, dual and plural numbers, and the various cases of subject and object, result in a total number of seventy-eight affirmative terminations for the present tense, in a transitive verb, all different; the whole number of different terminations in the indicative mood is eleven hundred and ninety, and of the whole verb is over three thousand one hundred, including the affirmative, negative, and interrogative forms. The non-transitive verbs have a smaller number. The verbs "to be" and "to have" are identical and possess very few forms.

Mr. DALL also gave an account of the anatomical characters of the conical univalve mollusks generally known as Limpets. These have been divided by Gray and other naturalists into two orders, according as the animal possessed one plume shaped gill over the back of the neck, or a cordon of lamellar gills all around the body. His recent investigation of the anatomy of many species, principally from the American coasts, had shown that the value of these distinctions was less than had been heretofore supposed. Some of the Limpets were shown to be entirely without special gills; others possessed a cervical plume-like gill, and also a cordon of accessory gills, greatly varying in extent in the different genera. For this reason he proposed to include them all in one order (named *Docoglossa* by Dr. Troschel) subdividing it into two sections characterized by the total absence, or by the presence, of gills. These suborders would respectively bear the names of *Abranchiata*, and *Proteo-branchiata*. The

Solenoconchæ and *Polyplacophora*, included by Troschel in this order, were to be eliminated; the former having the value of a subclass, while the latter form a well marked order. He concluded with some remarks on the synonymy of some of the genera most abundantly represented on our coasts.

Mr. THOMAS MEEHAN read a paper on "Nutrition and Sex in Plants." He referred to his "laws of sex," read last year, and now proposed to show that a decreased power of nutrition was one of the operating causes against that high state of vitality necessary to produce the female sex. He stated that there were two classes of male flowers on the common Chestnut (*Castanea Americana*), one from the axils of leaves on weak branches, the other terminating the vigorous shoots, only on which the female flowers are formed. The axillary male flowers mostly matured before the supra-pistillate ones opened. These were extremely weak, owing to the superior absorptive power of the females below them. He then exhibited some specimens of these, as well as some from a very large Chestnut tree, which had always borne abundant fruit, but had this year produced nothing but male flowers. The leaves were all striped with yellow and green, indicating, as every experienced gardener knows, that nutrition was obstructed. Plants over watered, by which the young feeding roots rotted, always put on this yellow cast. The yellow tint always followed "ringing" the branches, or any accident done to the bark. The influence of this *defective power of nutrition*, in this instance, he held so clear that he had no difficulty in concluding that it was *one of the agents which operated on the laws of vitality that governed the sexes.*

Prof. E. D. COPE of Philadelphia, read a paper on the "Reptilia of the Triassic Formation of the United States." He stated briefly the distribution of the rocks of Triassic age, and the localities at which vertebrate remains have been found. He stated that fourteen supposed species had been named, which had not been referred to their appropriate ordinal groups. He then pointed out that three of the genera, — Megadactylus of Hitchcock, Clepsysaurus of Lea, and Bathygnathus of Leidy, belonged to the order Dinosauria. This he had been unable to determine from the vertebræ, or even the limb bones, but from the pelvic elements. The structure of these in the first two genera was described and represented as a pair of coössified styles upon which the animal supported himself when in a sitting position. The fore limbs of the Megadactylus were rather long. The genus Clepsysaurus was, as Lea has pointed out, nearly related to Palæosaurus of the Bristol (England) conglomerate, while Bathygnathus was also related to the same and to Teratosaurus. Of the eleven species remaining, nine had been found by Prof. Cope to belong to the Thecodontia, and to be allied to the genus Belodon. He reduced the number of definable forms to four, stating that the remaining five were mostly established on the posterior teeth of the others. His fourth species he regarded as undescribed. It was the largest of the species, and was established on remains from Phœnixville, Penn., discovered by

Charles M. Wheatley. A portion of these was exhibited. They included bones of the extremities, pelvis, and vertebræ. The femora measured about thirteen inches in length. It was named *Belodon lepturus*.

The question of the greater or less generalization of types in the earlier ages was discussed, and evidence deduced from the Reptilia of the American Trias that such was the case. Thus there was much greater difficulty in distinguishing the Crocodiles and Dinosauria of the Trias, than those of the Cretaceous. This was to be especially seen in the forms of the vertebræ, and the femora. The Rhynchocephalia and Thecodontia were Triassic groups still more generalized and intercalated between the preceding and the later orders Lacertilia and Crocodilia. In the case of the former this was shown in the structure of the cranium and vertebræ; in the latter in the same regions, in the sacrum, in the extension of the rib-series to the latter, and in the limbs. The speaker explained that the structure of the quadrate region precluded the reference of the Triassic and Permian genera Parasaurus, Hyperodapedon, Telerpeton, Protorosaurus, etc., to the Lacertilia, as had been done by Huxley, but that they were truly Rhynchocephalia, an order represented by but one recent genus. He stated that he knew of no Lacertilian older than the Jurassic period.

Professor JAMES HALL read a paper "On the Relations of the Oneonta Sandstone and Montrose Sandstone of Vanuxem with the Hamilton and Chemung Groups." The object of this paper was mainly to correct some erroneous impressions regarding the geology of Eastern New York.

The sandstone referred to had been termed in the annual reports of Mr. Vanuxem the Montrose sandstone and Oneonta sandstone; the former a well marked locality in Pennsylvania; the latter in New York. This sandstone had been regarded as the terminal rock of the series, and as lying above the rocks of the Chemung group. The same views were entertained by Mr. Mather, who parallelized the sandstone of the upper part of the Catskill Mountains, with that of Montrose and Oneonta, giving a section from near the base to the top of the Catskill, without recognizing any important subdivisions.

In the final nomenclature the term Catskill group was adopted for the entire series. A red sandstone, which had been observed farther to the westward, along the Tioga River and upon the borders of New York and Pennsylvania, containing sales and bones of Holoptychius was regarded as part of the same group. Since this red sandstone of Tioga was known to thin out to the westward, it gave support to the hypothesis that it was only the thinning western extension of the formation which was so largely developed in the Catskill Mountains.

In the central and western parts of the State the limits of the Hamilton, Portage and Chemung groups, had been pretty well defined, the two latter occupying a great breadth in the southern counties. In the coloring of the map the great breadth given to the Catskill group in the eastern counties reduced the Chemung and Portage to a narrow belt giving an incon-

gruous aspect to the area, especially when we recognize the generally accepted view, that the source of the sediments has been to the eastward of these limits.

A few years after the close of the survey it was ascertained that in Delaware county, lying above the sandstones of Oneonta, there were several hundred feet of gray greenish and other sandstones and shales, containing the characteristic fossils of the Chemung group.

At the same time it was ascertained that the beds below the Oneonta sandstone in Schoharie and Otsego counties contained no characteristic Chemung fossils. The sediments it is true were found to be coarser than those of the Hamilton group in the central and western parts of the state, and contained the remains of land plants, but otherwise embracing the common characteristic species of that group. Waiting opportunities for farther investigation the results of these observations were not published, though the error has been partially corrected in the geological map published by the Geological Survey of Canada.

Later observations have served to verify the earlier conclusions, but there has been no opportunity of tracing out in a complete and satisfactory manner the limit of this sandstone formation.

An examination of the Hamilton group along the valley of the Schoharie creek, has shown that the more argillaceous deposits, with marine fossils, are succeeded by coarser beds with remains of land plants, and in the neighborhood of Gilboa numerous trunks of large tree-like plants have been found standing in the position in which they had grown. The entire thickness of the formation is not less than three thousand feet, and this is succeeded by the red and gray sandstone and shales originally described as the Oneonta and Montrose sandstones.

The entire thickness of this sandstone in Schoharie and Delaware counties has not been ascertained, but in the adjacent county of Otsego it is not less than five hundred feet, and is characterized by the diagonal lamination especially in the gray beds, and many of the layers contain remains of land plants.

The characteristic fossil Cypricardites* of Vanuxem is found in a shaly bed at the base of the sandstones in Richmond's quarry near Mt. Upton, immediately above a plant bed which, so far as at present determined, belongs to the upper part of the Hamilton group.

This sandstone so far as observed, rarely contains remains of fishes, and among them scales of Holoptychius, but all those seen had proved of distinct species from those of the Tioga red sandstone.

Lying to the south and above the sandstones we have the series of beds before referred to, containing the characteristic fossils of the Chemung group, and above this the sandstone and conglomerate of the top of the Catskill mountains.

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*The two species *C. Catskillensis* and *C. angusta* are both varieties of form due to pressure. The shell, however, is not a true Cypricardites.

The parallelism of the groups in the eastern and western parts of the State may be thus presented: —

Old Red Sandstone of Tioga, etc	Catskill Mt. Sandstone,
Chemung Group,	Chemung Group,
Portage Group,	Oneonta Sandstone,
Hamilton Group,	Hamilton Group.

In the central part of the State there is no sandstone bearing the character of the Oneonta sandstone; on the contrary, the Hamilton group is succeeded by a series of shales, flagstones and heavy-bedded argillaceous sandstones constituting the Portage group. These two formations hold the same relative position to the Hamilton group below and the Chemung group above. The western extension of the Oneonta sandstone has not been traced beyond Chenango county, but it seems probable that we shall find a gradual diminution in the coarser material, a coming in of argillaceous matter, and the absence of the evidence of cross currents producing diagonal laminations, leaving the deposits of the same epoch to be spread out evenly over the ocean bed.

We are not yet quite prepared to assert that the Oneonta sandstone of Eastern New York is the precise equivalent of the Portage group. The former, being the deposits of stronger currents, may have preceded or followed the epoch of the slates and flagstones of the Portage as seen on the Genesee valley. It will be only after a careful examination of the Oneonta and Montrose sandstones that we can speak with certainty of its relations to the Portage, but we are prepared to show that it has no near relation in time to the red rocks of the summit of the Catskill Mountains, nor to the red sandstones with remains of Holoptychius, which occurs along the Tioga and upon the borders of Steuben and Alleghany counties of the State of New York.

Mr. J. B. PERRY made a communication on "Boulder-trains in Berkshire county, Massachusetts." In Richmond, Berkshire county, Mass., there are six or seven nearly parallel trains of angular boulders, two of them particularly well defined. Attention was called to them years ago by Dr. Reid of Pittsfield. They have been also referred to, and in part described by Sir Charles Lyell, and the late President Hitchcock.

These trains originate partly in a range of hills consisting of chloritic slate, in Canaan, Columbia county, N. Y., but more especially in two other nearly parallel ranges of hills with a meridional trend near the State line in Richmond, Mass. The latter ranges consist of a greenish slate occasionally interstratified with beds of limestone. For the most part the boulders can be readily traced back to their exact source. Some of the trains may be followed south-easterly for four or five miles; others, passing over the Lenox range of hills, can be traced for ten or fifteen, and one of the larger for some twenty miles. Their direction during the first part of their course is south about 55° east. Somewhat farther on, they change their trend, it being some 35° east of south.

President Hitchcock presuming that there was a submergence of the

region, speaks of these lines of boulders as *osars*. Sir Charles Lyell also supposing a depression, thinks these boulders were transported by coast-ice.

There being no evidence of any considerable depression of this part of the continent during the Glacial Period, even if a submergence would afford an adequate explanation, which it does not, how are we to account for these boulder-trains?

As the vast ice-sheet which spread over the country gradually wasted, the elevations from which these boulders were derived would be at last laid bare. The ice no longer passing directly over the tops of the hills, there is evidence that the mass was parted, moving around the north-eastern and south-western sides of the several peaks. Of course, under these circumstances, the hillsides would be pressed and rubbed, blocks of slate and limestone detached from their places, and borne along upon the surface of the ice-sheet. This being at that time about six hundred feet in thickness, and continuing to thaw, the boulders would be carried forward for some distance, and finally left above the typical drift, as we now find them. As the ice wasted there would be changes in the direction of the moving mass, determined by the character of the underlying surface of solid rock, thus enabling us to account for the variation in the course of the boulder-trains.

Such, in brief, is the explanation suggested for these trains of angular rocks, and for some other similar phenomena in different parts of New England — an explanation in entire consonance with all the known facts connected with the glaciation of the country, and requiring no arbitrary resort to the theory of submergence.

Professor ORTON presented a paper "On the Evidence of a Glacial Epoch at the Equator," which controverted Professor Agassiz's theory of the glacial origin of the Amazon Valley. He briefly reviewed the statements made by Professor Agassiz that the Amazon formation did not contain a single marine fossil, and therefore was the product of an immense glacier that slid down from the Andes to the Atlantic. Professor Orton however, in his expedition across the continent, discovered an immense fossiliferous deposit at Pebas on the Maranon, and subsequent researches, carried on under his direction by Mr. Hauxwell, had resulted in the discovery of several other localities abounding in tertiary shells. A series of these were exhibited to the Association and excited considerable interest, not only from the novelty of their forms, but also from the fact that they were found in the heart of the great valley where Agassiz declared there were none. The shells are of fresh or brackish water types, and plainly indicate that the Valley of the Amazon, like the Pampas of La Plata as shown by Darwin, is an estuary creation, or the relic of a vast Mediterranean of fresh-water. In the minds of geologists present, these fossils settled the question of the origin of the valley; it was illogical and absurd to assume a glacial winter within the tropics when we do not dis over one solitary sign of its presence, —striæ and boulders are

not visible, and in their stead extinct shells are abundant. Professor Agassiz has declared that the Amazon clays are "drift" from the Andes transported by glaciers and ground down to an impalpable powder. But these fossils, some of them very delicate, are marvelously well preserved. Two explanations of the existence of these fossils have been given: (1) That they are accidental, being fragments of some formation elsewhere, mingled with the drift. But this hypothetical formation cannot be found. The valley is bordered by either palæozoic or cretaceous rocks. Besides, the fossils are *in situ* and identified with the peculiar Amazonian variegated clays. They must have lived and died in the vicinity of the spot where they are now found. (2) That the beds in which they are found may overlie the drift like the marine clay beds of Champlain. But the fossils are plainly of the same age as the formation in question, and cannot be later than the Pliocene. Moreover, the terraces which would result from submergence are not discernible within or on the borders of the valley.

Professor Orton then alluded to the glacial transmigration hypothesis, and showed by a comparison of the flora of the United States, and that of Andean highlands, that there had been no mingling of plants such as would have resulted had a vast glacier covered the whole or even the greater part of North America. And the conclusion reached was that facts were incompatible with the existence of an equatorial glacier and even of an intertropical cold epoch.*

Mr. R. W. Raymond, United States Commissioner of Mining, gave a description of certain typical physico-geological phenomena of the Pacific slope. The speaker, to save the time of the meeting, condensed into one rapid talk the substance of his two papers on "The Lava-ducts of Washington Territory," and "The Great Salt Marsh of Silver Peak, Southern Nevada." The former, he said, was a picture from the heart of the great volcanic overflows of the North, and the latter an equally characteristic scene from the region of solfataric and thermal-aqueous metamorphosis in the South. The accumulation of ice in the subterranean lava-ducts, the disappearance in them of streams ("lost rivers"), and various other features were briefly alluded to. The speaker ascribed the alkaline deposits of the Nevada basin to the decomposition of the soda-felspar abounding in the rocks, by means of hot gases and waters, and the subsequent percolation of these into the valleys.

Professor C. H. Hitchcock presented a paper upon "The Geology and Topography of the White Mountains." The topographical results were embodied in a model which he exhibited — a raised model on the scale of three-fourths of an inch to one thousand feet. This model is about four

*The fossils above referred were given to Mr. Conrad for identification. He distinguishes seventeen different species—all extinct, belonging to nine genera, of which only three are now represented. The species are *Isaea Ortoni*, *I. lintea*, *Liris laqueata*, *Ebora crassilabra*, *E. bella*, *Hemisinus sulcatus*, *Dyris gracilis*, *Neritina Ortoni*, *Bulimus linteus*, *Pachydon* (*Anisothyris*) *tenuis*, *P. carinatus*, *P. obliquus*, *P. erectus*, *P. cuneatus*, *P. ovatus*, *P. altus*, and a bivalve allied to *Mulleria*. Duplicates of these singular forms can be obtained of Professor Orton.

feet long, and shows the territory bounded by the Ellis, Saco and Peabody rivers. It is colored to show the distribution of the several formations. These are (1) several varieties of gneiss, called the White Mountain series; (2) granite; (3) eruptive granites and traps; (4) Staurolite and andalusite rocks belonging to the Coös group. The first group composed the main range of mountains in order from north to south, namely: Madison, Adams, Jefferson, Clay, Washington, Monroe, Franklin, Pleasant, Clinton, Jackson and Webster. Contrary to previously received opinions, it was said that the structure of this ridge is anticlinal and not synclinal, and the force crowding it up came from the north-west instead of south-east, as is the case everywhere else in the country. The relations of the granite to the schists is interesting. It is plain that the immense granitic area was eruptive, for at the boundary of the two enormous veins of granite had been injected into the schists. In the Saco Valley below the Notch, the granite occupies the lower area, and the schists upon the bordering ridges dip away from it in an anticlinal manner. The granite is the softest rock among the mountains, and therefore it is found chiefly in the valleys. These valleys have very abrupt sides, thus resembling the Yosemite valleys in California. The Professor could not agree with the theory of the California geologists, that the bottoms of these valleys had fallen out, he rather believed in the old-fashioned theory of denudation. The Coös group is a new one, it is not less than ten thousand feet in thickness, and is composed of a quartzite and limestone with staurolite slates and schists. It is characterized by the presence of silicates of alumina destitute of alkalies — and the minerals are staurolite, andalusite, and kyanite. Formations containing these minerals occur in New Hampshire, Vermont, Massachusetts, Canada, Nova Scotia and New Brunswick, and they were referred to this new group. The same had been described by Dr. Sterry Hunt a few weeks previous in the "American Journal of Science" as the Terranovan series, and some fossils of the Potsdam Period had been found in it in Nova Scotia. It would hence appear that this new system lies at the base of or below the Silurian, not far from the anciently supposed position of the *Taconic System*. That system had been the subject of violent discussion for twenty years, and he hoped that such results would not follow the proposal of the new *Coös Group*.

He next exhibited specimens of a new species of trilobite (*Acidaspis Whitfieldi*) from New Jersey, obtained from a boulder which was transported from New York by the glaciers. It came from the Marcellus slate. No other species of this genus had heretofore been found above the Schoharie grit.

Professor C. H. Hitchcock presented an argument to prove that a large portion of the North American Continent had been submerged beneath the ocean since the Drift Period. The proofs relied upon to maintain this position are the existence of twenty-seven species of maritime plants in the interior along the great lakes. These were specified by name and locality, extending up the Hudson River and Champlain valley and the

lakes of Ontario and Erie to Minnesota. He argued that these plants were originally introduced by natural emigration along an ancient estuary, and that many of them remain to the present day in consequence of the existence of conditions favorable to their preservation. He supposed that the plants about the salt springs in Northern New York were introduced in the same way. The pre-glacial flora has been completely destroyed by the intense cold, and while a new creation might explain the existence of salt water plants about the springs, it would not show why these marine plants could exist in the far interior. There should be a special fitness of species to conditions, in case the creation theory is invoked. He concluded that the continent must have been submerged two or three hundred feet lower than geologists had supposed, relying upon the ordinary arguments, and that the clays about Superior and Erie must have been of marine or estuary origin. It was quite unexpected that the present distribution of plants should throw so much light upon geological questions, and therefore it was urged that botanists should faithfully preserve the localities of all their specimens.

Professor T. STERRY HUNT said the presence of black iron sand upon many sea beaches has long been noticed both in Europe and America. Their origin is to be found in the crystalline rocks, from the disintegration of which these sands have been derived. The action of the waves, by virtue of the greater specific gravity of these sands, effects a process of concentration, so that considerable layers of nearly pure black sand are often found on shores exposed to wind and tide. These black sands vary in composition according to the localities, but as found on the coast of New England and the Gulf of St. Lawrence consist of magnetic oxyd of iron, with a large admixture of titaniferous iron ore, and more or less garnet, the purest specimens holding from thirty to fifty per cent. of magnetic grains. Such sands have long been employed as sources of iron in India, where they are directly converted in small furnaces into malleable iron. Early in the last century the considerable quantities of these sands found on our Atlantic coast attracted the attention of the colonists and of scientific men in England, and the Virginia sand-iron, as it was called, was the subject of many experiments. The first successful attempts at working it were, however, made in Killingworth, Conn., where the Rev. Jabez Elliot, grandson of the celebrated John Elliot, the apostle of the Indians, early turned his attention to the abundant black sands of the coast, and succeeded in treating them in a forge fire similar to the German forge or modern American bloomary fire. It appears from his account laid before the Royal Society of London in 1761, that he was then making iron blooms of fifty pounds weight from this ore, and that his son had already established a steel factory in Killingworth, when an act of the British Parliament forbade the manufacture of steel in the colonies. The London Society of Arts in 1761 awarded a medal to Mr. Elliot for his discovery. The working, however, was abandoned, and for a century no attempts were made in America to use these sands. Some four years

since the large quantities of them in the lower St. Lawrence attracted attention, and successful trials were made for their reduction in the bloomary fires of Northern New York, after which an establishment for working them was erected at Moisie in the Gulf of St. Lawrence, where, under the direction of skilled workmen from Lake Champlain, the treatment of these iron sands has been successfully carried on. These sand ores are remarkably free from both sulphur and phosphorus, and hence yield an iron of great purity and toughness. The working is effected in forges like those used on Lake Champlain, and presents no difficulties.

Prof. W. C. KERR remarked "On some points in the Stratigraphy and Surface Geology of North Carolina." The two long narrow belts (troughs) of coal-bearing triassic rocks in North Carolina, lying, nearly parallel, in a direction a little north of east, and separated by an elevated and rolling tract of metamorphic and granite rocks fifty to seventy-five miles wide, are found to constitute the fragmentary fringes of an eroded anticlinal, the one dipping north-west at an angle of 30° to 75°, the other south-east 10° to 35°. The material of this formation was furnished mainly by an ancient plateau or mountain chain lying eastward, between the mesozoic and the Atlantic, which "has left no sign" of its existence but this. I have found no trace of glacial action in North Carolina, even in the most elevated mountain plateaus, but abundance of Quaternary gravels, whose position is such as to negative the existence of glaciers in this latitude. Among these deposits occurs a remarkable peat bed, fifteen feet thick and about one hundred yards long, recently exposed in a railroad cut. Its position is very peculiar, at an elevation of more than one thousand feet above the sea, and near the top of a hill one hundred feet above the valley of the Catawba River (which is one mile distant), and twenty-five miles from the Blue Ridge. It is covered and protected by eight to ten feet of fluvial gravel and sand. It is peculiar also in its contents, being made up in considerable part of drift wood, and containing abundance of pine and hemlock cones (there being no hemlock forests nearer than the Blue Ridge) and other seeds, and also of charcoal, partially burned pine knots and charred logs.

Another peculiarity is that the peat, occupying the middle of the nearly vertical face of the cut (some eighty feet deep), and being exposed but one season, has put forth an abundant swamp vegetation, consisting of carex, juncus, and several species of swamp grass and weeds.

There are evidences in eastern North Carolina of considerable oscillations of sea level during the prehuman period (probably synchronous with the Champlain epoch). The accumulations of stratified gravels on the summits and slopes of the hills, at an elevation of more than three hundred feet above the present sea level, extending entirely across the State, at a distance of one hundred and twenty-five to one hundred and fifty miles from the coast, indicate the extent of this movement in one direction, while the minimum of elevation is indicated by the excavation of the channel of the Cape Fear River (e. g.) for more than thirty miles to a depth exceeding one hundred feet below the present tide level.

Professor W. C. KERR on the "Probable Origin of the South Carolina Phosphates." The physical circumstances of the deposition of these beds in their present situation, have been explained in a manner sufficiently probable by Professor Pratt of Charleston; but I have seen no suggestion which is at all adequate to account for the origin of the materials which compose them,—the elimination and accumulation of such enormous quantities of phosphate of lime in so peculiar a situation.

The recent discovery of the singular Brachiopod, *Lingula pyramidata*, in the shoals along the sounds of North and South Carolina furnish a solution of the mystery. This shell, it will be remembered, consists of *phosphate* instead of *carbonate* of lime. Its habitat is at the precise level of the Ashley River phosphates, and the shell being very fragile and left within the play of the tides in the shifting sand of the shoals, rapidly loses its form and furnishes only its solid material, to be agglomerated by some concretionary or other chemical or chemico-mechanical force into the nodular masses which are so peculiar to this formation.

THE MICROSCOPICAL SUBSECTION OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE, which was initiated at the Salem meeting last year, was continued with renewed interest and increased numbers at the Troy meeting this summer, and promises to be a permanent and useful division of the Association. Under the Constitution, as amended this year, this department is removed from Section B (Natural History), and recognized as Subsection C of Section A (Mathematics and Physics). This arrangement, though somewhat confusing, is probably the most convenient that could have been made; microscopy proper, the science of the instrument, belonging strictly to mathematics and physics—but microscopy applied, the use of the instrument, being chiefly a department of Natural History. To avoid confusion at this point, authors of Natural History papers designed for this department should make a memorandum to that effect upon their MSS., as a request to the standing committee to assign them to Section A instead of Section B.

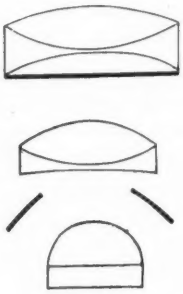
Professor S. S. HALDEMAN, of Columbia, Pennsylvania, was elected *Permanent Chairman* this year; and Dr. R. H. WARD, of Troy, N. Y., *Secretary*.

Although this subsection, having been recently formed, has necessarily been much occupied with the details of its own organization, it has already done much work and contributed some valuable papers, among which were the following, of which abstracts are published elsewhere: "On a new form of Binocular Microscope," by President F. A. P. Barnard, of Columbia College, N. Y., describing elaborately a newly contrived instrument in which the light is separated into two pencils by double refraction, and which cannot fail to be a valuable addition to the resources of the working microscopist; and "on the Illumination of Binocular Microscopes," by Dr. R. H. Ward, of Troy, suggesting convenient means of regulating illumination in the naturalist's every day work with the microscope, and urging that professional microscopists make their influence

more distinctly felt in regard to the lower classes of instruments that are furnished to beginners, and particularly in regard to popularizing the Binocular Microscope.

In exhibiting photographs by Dr. Maddox of the Podura scale, President Barnard gave an exhaustive review of the discussion in regard to the structure of the scale. The traditional "note of exclamation," or goose-quill markings are unlike those of any other known scale, and many naturalists are anxious, on grounds of analogy, to get rid of them. Mr. Beck argued that these marks represented parallel lines on different sides of the scale, crossing each other at an acute angle, and necessarily imperfectly focussed; some observers have attributed them to corrugations or folded ridges of the upper and lower membranes of the scale; and Mr. Pigott, with his aplanatic searcher, and others have seemed to resolve them into bead-like rows of spherules, between two membranes. The use of reflected light to determine these points is very desirable, but difficult with sufficiently high powers. Professor Smith, of Kenyon College, proposed to make the objective its own illuminator. Others have replaced the mirror he placed behind the lenses by a plate of glass or a prism; but all these means give a glare of light by reflection from the surfaces of the lenses. The speaker had proposed a concave mirror behind the outer pair, an internal Lieberkuhn (fig. 100) which works exceedingly well with medium powers, say one-third or one-fourth inch; but there is not room for its insertion in high powers. As compared with Tolles' prism, which is similarly situated (above the front pair), it gives more light, and illuminates from any part or all parts of the circumference at will; on the other hand it is less easily applied, requiring the front lens to be mounted in glass instead of brass, and it is inapplicable to large opaque objects. The beaded appearance has not yet been satisfactorily seen by reflected light; nor is it well shown in the photographs where the wedge-shaped dashes seem rather marked by crosslines or partial interruptions. The speaker evidently doubted the accuracy of the exclamation points, but was not yet ready to accept the beads. Appearances best seen by pushing an objective far beyond its ordinary power were received with general distrust.

Fig. 100.



In the discussion which followed the reading of this paper, Dr. Ward remarked that the production of a beaded appearance, as a purely optical effect, should be considered no longer doubtful, but rather an occasional accident to persons using high powers. As an extreme instance, in the case of a coarse and familiar structure, he related that while experimenting upon an elater of *Marchantia polymorpha*, that beautiful double spiral

was "resolved" into three rows of "beads" or "hemispheres," perfectly distinct and unmistakable, which occupied, of course, the position of the middle and edges of the spiral. They were illuminated by parallel light, very oblique, under a 1-15 objective of 175° worked at a power of 3,000 diameters.

Mr. E. Bicknell, of the Museum of Comparative Zoology at Cambridge, Mass., exhibited some diatoms recently thrown up by the sea at Marblehead, Mass. The deposit first found belonged to brackish water, as indicated by the nature of the diatoms and the presence of fruit of the *Characeæ*. The second deposit occurred about a mile from the first, and was purely of fresh-water origin; consisting of peat with fresh-water diatoms, — *Pinnularia*, *Stauroneis*, *Navicula rhomboides*, *N. serians*, etc. These deposits were thrown up by a severe storm on the 31st of March last, and are believed to be the first fresh-water or brackish deposits known to exist under the present ocean. They seem to be conclusive proof of the recent encroachments of the ocean upon the shore-line in that vicinity.

The Test Plate of Nobert, who has now "gone to the war," and Dr. Woodward's photographs of the same, were exhibited by Dr. Ward, chiefly in the interest of that part of the audience who were not professional microscopists, and might be unfamiliar with these wonderful works of human art. Until a year or two ago the finest lines had never been seen, even by the maker of them; now they have been seen by many persons, and have been photographed. He was now satisfied, for the first time, after hearing Mr. Bicknell's description, that the Boston microscopists had seen the *genuine* lines with powers of only five or six hundred diameters. In regard to the use of photography as a test of structure under high powers and difficult circumstances, we may learn a lesson from the broad bands of light and shade in the photograph of the coarser lines, which manifestly have no resemblance to the appearance of scratches on glass as seen under suitable powers.

Dr. Ward had also been investigating the effect of seeing two planes of the object at the same time with the Wenham's Binocular. The eye-pieces being practically not equidistant from the objective, the corresponding conjugate foci below do not coincide. Some microscopists have attributed much of the stereoscopic effect to this fact, which, however, does not seem to contribute perceptibly (except in the lowest powers, where the angular stereoscopic effect is necessarily very small, and where this difference of planes is most considerable), either to the stereoscopic effect, or to the increased distinctness of definition above and below the plane of most perfect vision.

An abundance of instruments were furnished by members to illustrate their discussions, or for the general work of the subsection. The first class stands were mostly of the make of Powell and Leland, and Beck, and Crouch, of London, of Nachèt of Paris, and of Zentmeyer in this country. The "Jackson" model of stand, with a curved arm, seems to be

growing in favor here; and it is to be hoped that those makers who have heretofore made only one style of stand will soon offer both; so that buyers can choose their style of stand irrespective of their choice of makers. In objectives and accessories Tolles, Wales, Zentmeyer, Grunow, Spencer, Miller, and some other American makers were represented; also Ross, Beck, Powell and Leland, Crouch, Collins, Murray and Heath, Swift and Browning, of London; Nachèt and Hartnack, of Paris; and Gundlach of Berlin. Very low power objectives, 3 and 4-inch, were deservedly popular. The use of immersion objectives for all high powers seemed to be assumed by all members as a settled question. Few members, on the other hand, fall into the present fashion of high power objectives,—preferring to use lenses of 1-15 or 1-16, and downward, and gain greater amplification by other means than by reducing the nominal focus of the objective.

Dr. Josiah Curtis exhibited a micro-telescope, or microscope and telescope combined, made to his order by Tolles. It is an ordinary Cutter's clinical microscope, fitted with an extra tube carrying an object glass of one inch linear aperture and six inch focus, to which objective the compound microscope acts as an erecting eye-piece. Furnished with a proper support this makes an admirable pocket telescope, defining well at powers of forty or fifty diameters.

Mr. Tolles had mounted a 2 1-2-inch lens with the society screw on each side of the shoulder, so that it can either be screwed on in the usual position, or passed up into the body of the instrument and fastened there, giving, by approaching the eye-piece, about the power of a 4-inch lens at the usual distance. Microscopists have been accustomed to gain a lower power than could be focussed by their rack, by screwing a low objective into the drawtube and focussing upon the object through the empty nose-piece. The new plan of a reversible mounting is more convenient, and is applicable to instruments that have no draw-tube; unfortunately it cannot be used with the ordinary Binoculars. The lens, though of second class, was very good.

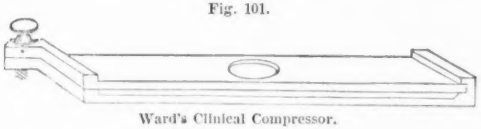
Mr. Tolles has also arranged a 4-inch objective in which a short working focus is obtained by a reducing lens in the rear. This reducing lens, for convenience, is mounted in a sliding tube, and gives when pushed in a fair 3-inch power. As a 4-inch the combination is extremely good.

Mr. Bicknell applies this expedient to ordinary objectives; placing in the draw-tube, instead of the concave amplifier sometimes used, an achromatic convex lens as a reducer, with which an extremely low power can be obtained with good definition, flat field, and working focus not inconveniently long. A 4 1-2 or 5-inch lens (solar focus) may be used. A low objective of two combinations may be divided, using one part as an objective, and placing the other in the draw-tube.

Dr. Ward had contrived a "clinical" compressor for use with the microscope of the same name. The clinical microscope is very convenient for examining mounted specimens, which is exactly what it is not wanted

for — except by teachers. He had used it for years in teaching, but not much as a "clinical" A glass slide to hold the object, with a thin cover held on by capillary attraction, is well for once, but does not satisfy a busy man. It applies to too limited a range of objects; and the cover is inconvenient to carry, awkward to handle, and easy to break. He had used Wenham's compressor until lately, but that is inconvenient under the springs of the "clinical" stage. The new compressor, figured below, is simple (and therefore inexpensive) and can be used with great facility both for clinical and class use, and for much of the ordinary work of the microscopist. It is reversible, except upon a large stage, in which case it would require a few pins to serve as legs. The want of parallelism is less than in most compressors, and is not inconvenient in clinical use. The two brass plates separate entirely for arranging the object or cleaning the glass. The upper plate fits into a notch filed in a ledge at the left of the lower, the centering of the two plates being secured by a pin through the lower and a notch in the upper. The screw which attaches them at the right is permanently fastened in the upper plate by a groove and a pin. It has a coarse thread, which may be cut double to screw out more rapidly, or the thread may be reversed near the centre so that it will at the same time raise the upper and depress the lower plate. Should a steadier motion be required, a spring may be riveted upon one plate to press against the other. The apparatus is adjusted for a glass of 1-20

Fig. 101.



Ward's Clinical Compressor.

inch below the object and 1-125 above, cemented upon the inner surface of the brass plates. This is strong enough to carry in the pocket safely; it can also be used with the parabolic illuminator, or with any objective or achromatic condenser except those of large angular aperture. Should thin glass be required for any purpose, a glass or tin cell of sufficient thickness to make up the difference should be cemented on one of the plates, or both if necessary, and the thin glass fastened upon the rim thus formed. Should no cell of suitable thickness be at hand, select a glass cover of the required thickness, fasten it with marine glue on one of the plates, punch out with a file the part corresponding to the opening in the plate, and then fasten the thin glass with Canada balsam upon this extemporized rim.

Mr. E. B. Benjamin, of New York, exhibited a microscope by Gundlach of Berlin. This was a small and cheap instrument, according to the English and American standard, but really admirable for its neatness of design and finish, and its general excellence of performance.

Beck's "popular" microscopes, binocular, were exhibited by Mr. C. E.

Hanaman and others. They have already vindicated their name in this country as well as at home.

Mr. Charles Stodder, of the Boston Optical Works, exhibited Cutter's clinical microscopes, and Tolles' students' microscopes, of various degrees of completeness and cost. These instruments are already too well known in this country to require comment. That they are thoroughly good of their kind is what is claimed for them, and is the least that can be said of them. In buying a students' microscope, however, the beginner should always be advised, in the writer's judgment, to have it furnished with a first class 1-inch objective or something very near it. So much of his early work is, or ought to be, done with this power, and his success as well as pleasure depends so much upon its light and definition, that it ought to be the last point economized upon. The sliding stage upon some of these instruments would seem to be easily convertible, for those who wish it, into a White's lever stage.

Mr. F. Miller, of New York, exhibited a good students' microscope of very low cost. It is chiefly notable for its large body, which admits a large eye-piece and gives a good field. Mr. Miller also exhibited excellent illuminating prisms and various accessories and objects, including Möller's beautiful type plates.

Crouch's educational microscope had a larger body than even Miller's, admitting the use of the same eye-pieces as the first class stands. The advantage of this is enormous in the case of the lowest eye-piece.

Blankley's neat and convenient tank microscope, made by Swift of London, was exhibited by Dr. Ward. Also Murray and Heath's "seaside."

Of the general business of the subsection the most important was the appointment of a committee to report in relation to uniform standards in the power of objectives, eye-pieces, etc. President F. A. P. Barnard of New York, Mr. E. Bicknell of Cambridge, Mass., Dr. R. H. Ward of Troy, N. Y., Professor C. E. Pickering of Boston, Professor O. N. Rood of New York, and Dr. Josiah Curtis of Boston, constitute this committee.

ANSWERS TO CORRESPONDENTS.

J. J. H. G.—The Humming Bird you describe is the male of the common Ruby-throated Humming Bird (*Trochilus rubris* L.). The female and the young are without the brilliant scarlet color on the throat seen in the males. After midsummer the scarlet throated individuals are far less numerous than the others. There is but one species of Humming Bird in the Northern States.—J. A. A.

J. M. J., Halifax.—We will endeavor to name the collection of marine invertebrates for you.

S. A. W., Bucks Co., Pa.—Your fern is *Osmunda regalis*.—J. L. R.

S. L., Freehold, N. J.—The caterpiller is that of *Pieris rapæ* Shrank, which was introduced from England to Quebec in 1856 or 1857, and is stated to destroy annually $240,000 worth of cabbages in the neighborhood of that city. It thence spread into New England, and is now common about New York and Philadelphia. It feeds concealed on the heart of the cabbage, while the two other species of Pieris, *P. Protodice* and *P. oleracea*, feed on the outer leaves.

The other specimens were the pupæ of a species of Syrphus fly, which feeds on the plant lice, so abundant on the cabbage in the autumn. The Syrphus fly is of course very beneficial.